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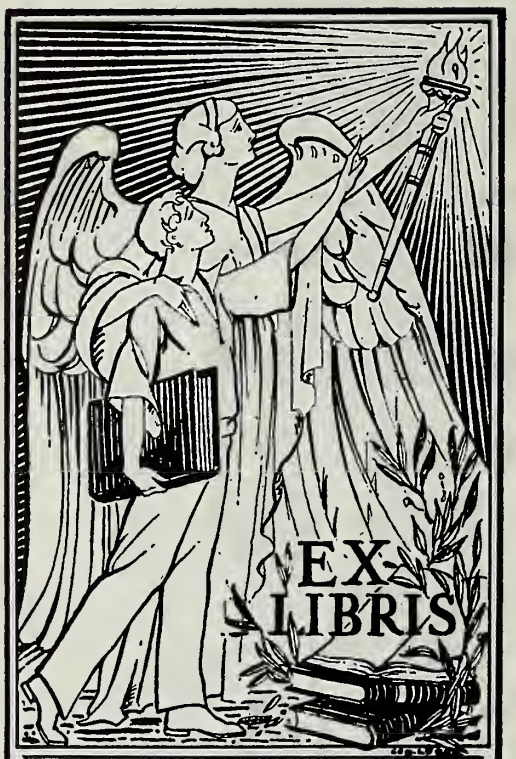
AT

ELEMENTARY GRADE LEVELS

Samuel Clements Ashcroft



ERRORS IN ORAL READING OF BRAILLE AT ELEMENTARY GRADE LEVELS

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The intent of this study was to provide useful information on reading in the medium of braille through critical analysis of the type, frequency, and level of errors that occur in children's oral reading at elementary grade levels.

Children in the second through sixth grade of public day and residential educational programs for blind children were asked to read aloud braille materials especially prepared for the purpose. The materials utilized the features of the braille code in twelve concise but interesting paragraphs of controlled and graded reading difficulty.

Data descriptive of the characteristics and behavior of the 728 readers were obtained. The errors made in connection with the reading in individual test situations were recorded verbatim in prescribed form. The relatively low incidence of identifiable error, an average of five errors per 100 words read, made impractical many analyses proposed at the outset of the study. Analyses for differences related to sex, educational placement, and reading history are examples.

The analyses of the findings were made on the premise that reading, regardless of medium, fundamentally involves the same psychological processes and has as its purpose the communication of meaning. An analysis of errors from the standpoint of seven types of braille orthography

indicated that words having short forms prescribed by the braille code proved most difficult of the orthographic types for all grades. Words for which orthography required multiple-cell contractions were second most difficult. Words made up of combinations of orthography were third in order of difficulty. Words in these three types of orthography, while comprising 27.7% of the words in the paragraphs had associated with them 46.3% of the errors made. Words in four other types of orthography, that is full spelling, alphabetic abbreviations, upper contractions, and lower contractions contributed 74.3% of the paragraph content, but had associated with them 53.8% of the errors made.

The errors, largely falling into eight types, were attributable to three general problems. Problems related to perception included missed dot, added dot, and ending errors. Problems related to orientation included reversal, vertical alignment, and horizontal alignment errors. Problems related to meaning included association and gross substitution errors.

The findings suggest that fruitful opportunities to reduce the number of errors in reading can be found in selection or preparation of appropriate braille materials and the instructional use of them. Further research is suggested on teaching practices, graded materials, and braille code revision.

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CHAPTER I

THE PROBLEM

More than twelve thousand children who come within the accepted definition of blindness are being educated in the United States today. This is the largest enrollment of such children ever recorded in this country's century and a quarter history of education for children who are blind. While this is but a small fraction of the total number of children presently being educated in the United States, that it is an important group in the concern of educators is evidenced by the fact that each state makes some specialized provision for the education of its young blind (Saterlee, 1959).

Since the establishment of the first schools for the blind in this country in the third decade of the nineteenth century, more than 50 residential schools have been established. Concurrent with the establishment of residential schools and the growth of this movement, there have been efforts to develop day school programs. Such programs were started as early as 1900 (Farrell, 1956) and have grown in number until today more than 200 classes (Cruickshank, 1958) provide for over 40 percent of the enrolled population of children who are blind. With upwards of 250 small and geographically widely separated educational facilities developing programs, there has tended to be a diversification of programs and at least the factors of smallness in size, geographic separation, and variation in provision have tended to discourage the development of concerted attacks on problems associated with the education of blind children.

The education of the blind involves all of the problems of the education of children in general, since they are first of all children and since they have the same needs, wants, and desires and since educators seek the same goals for them (Henry, 1950). However, educational problems in connection with programs for the blind are increased by today's greater incidence of blindness in

children and they are more widespread through the diversification and growth of educational programs. In addition, the education of these children entails many unique problems. Some of these unique problems grow out of the fact that children who are blind must accomplish much of their education through tactual means, and to be literate, they must read and write through the use of a tactual system.

The tactual system of reading that has been generally adopted since 1920 is braille, and reading through the use of braille is one of the most important tools which the child who is blind must acquire. Indeed, it has been said that reading may be even more important for the child who is blind than it is for sighted children. Lowenfeld (1945) made the point in this way:

> "Reading holds a central position in the education of blind children. This is so not only because it is a tool they need in order to follow the course of study in practically all the other school subjects, but also because it opens to them doors to a world from which they are more removed than other children . . ."

There is abundant evidence that reading through the use of braille and teaching reading through this medium presents unique problems. As Irwin and Wilcox (1929) have pointed out,

> "At best, braille is but a poor substitute for the efficient tool which the inkprint page has proved in the hands of those with sight."

Pintner (1941) has said,

> "Braille reading is slow and difficult. In spite of all the best schools can do, it would seem that the blind child is handicapped in acquiring information and in fluent reading, and that he does not catch up with the seeing child as he grows older."

Burklen (1917), Hayes (1941) and many others have pointed out that braille reading is accomplished at rates on the average about one third the rates at which inkprint reading is done. As Loomis (1948) indicates,

> "When Valentin Hauy, the father of embossed printing first produced his raised letters, he was quick to realize that the number of characters would have to be reduced. The finger cannot travel as rapidly as the eye so that tactual reading will be slower than visual."

There have been efforts to ameliorate the problem of the slowness of rate of reading in the medium of braille. Loomis (1948) says,

> "The first attempts to offset this disadvantage consisted of condensing the reading material itself. In view of the fact that most of the books were texts, the omissions were serious. The important fact, the one which should always be remembered, is that, from the very beginning of tactual reading, educators discovered that embossed materials should, in some manner, reduce the number of symbols. Deciphering long words, with every letter requiring individual recognition, was a slow process. The continuity of thought could not be carried rapidly enough to call it reading."

Problems of slow rate are not the only ones that have been recognized. Lochead (1943) comments,

> "It is generally agreed that it is a moderately difficult matter to learn to read braille; but apparently it is the easiest thing in the world to teach braille. There has been little systematic research in the best methods of teaching braille to children and adults. The teaching of any subject is a science, and during the last fifty years much careful research has led to improved methods and clear aims in the teaching of almost every subject. Not so with braille. Each teacher has his own particular methods, based mainly on vague tradition, with little precision of aim."

Loomis (1948) wrote,

> "Braille may rightly be termed the stepchild of work for the blind; it has important duties to perform; it has a vital place in work for the blind; but those around it seem to shun it and permit it to care for itself as best it can. This unfortunate condition has, in very recent years been noticed; progress is being made in the right direction; but the subject has not yet reached the position of prominence that is required if satisfactory results are to be attained.

Martin (1933), while showing that residential school programs for the blind have been changing their roles from the pursuit of protective, welfare-type objectives to seeking essentially educational goals, indicated that they still lack accurate information about the learning process. This lack of knowledge she found reflected in the program of studies and the methods of teaching.

Lowenfeld (1955, Cruickshank) has written,

> "Although a beginning has been made, the whole area of touch reading poses many problems as yet unsolved, and even uninvestigated. Readability of letters and contractions, the mental processes involved

in touch reading, methods of touch reading, methods of teaching touch reading to children and to adults, reading readiness and its indications, are all problems which need investigation.

Sound educational programs for the blind aim to minimize the handicap of limited vision and to bring visually handicapped children to a point of educational achievement commensurate with their mental capacity. If the programs are to attain this objective, many problems in connection with reading through the use of braille must be investigated and solutions to them must be sought. Today's expansion of diversified educational programs intensifies the need for comprehensive study of difficulties in braille reading.

Purpose of the Present Study

The intent of the present study is to provide useful information on reading through the medium of braille through critical analysis of the type, frequency, and level of errors that occur in children's reading. The study attempts to determine the nature of errors and their relative prevalence. It seeks to discover the types of errors which tend to persist through elementary grade levels. An objective of the study is to provide a means for the early identification by teachers of errors and to suggest how these errors may be remedied or avoided. Once a means of early identification is made possible and means of remediation understood, prevention of these errors should be possible. The investigation should provide a better basis for understanding braille reading behavior. It should throw needed light on current teaching methodology and suggest possible changes in methods and materials that will facilitate more accurate and rapid reading through the use of braille. Out of this study can come useful information for programming the introduction of the symbols of the braille code in children's literature. It can provide a basis for describing the graded reading difficulty level of materials transcribed from inkprint into braille. The study should have important implications for guiding future braille code revision and

should provide an important base for additional needed research on effective use of braille as a medium of reading.

Definition of Terms

Braille: In the context of this study, braille refers to Standard English Braille, Grade II as defined by the Uniform Braille Committee.

Grade II: Grade II refers to the level of braille in terms of the number of contracted forms that are used. Grade I braille contains no contractions. Grade I and one half braille contains 44 contractions. Grade II braille contains 185 contractions.

Cell: A braille cell ⠿ is the space required for the six possible dots or any of the sixty-four possible combinations of dots. Sixty-four includes the one possibility which would contain no dots which is used as a space (cell space). The number of possibilities, 63 plus a blank, 64, is obtained from two to the sixth power (2^6). The cell's dimensions are described in thousandths of an inch. The distance between corresponding dots of adjacent cells is .250 of an inch.

Contractions: Contractions are braille characters or groups of characters which represent more than one letter. For example, a "b" ⠃ when written to stand alone (with a cell space on either side of it) represents the word "but". The character for "k" by itself stands for "knowledge". Each of the 26 letters of the alphabet, when standing alone, has a particular meaning as a contraction. The letters of the alphabet, when written adjacent to other letters, are understood to have their letter meanings.

Signs: Signs are braille characters which represent marks of punctuation; composition, mathematical, music, chemical, and other types of symbols.

Abbreviations: Abbreviations refer to a series of 73 words which are represented by abridged forms, for example: "ab" ⠁⠃ for "about", "rcv" ⠗⠉⠧ for "receive"; and "yr" ⠽⠗ for "your".

Reading: Refers to the apprehension of meaning from symbols embossed on paper in dot form, and in the context of this study refers to oral touch reading through the use of Standard English Braille, Grade II by children who come within the accepted definition of blindness.

Blind: Refers to the absence or lack of vision defined in the accepted definition of blindness (Kerby, 1940) and/or a vision problem serious enough to require enrollment in a class or school for children who are blind, or a vision problem so serious as to necessitate the use of touch as the chief modality for reading.

Day Class: Day class refers to the educational facility established in a local school system for the education of children who are blind. These children live in the community served by the local school system.

Residential School: Residential School refers to the educational facility established as a boarding-in educational unit especially established for the education of children who are visually handicapped. A few children at each such school live at home and attend the residential school on a day-school basis, but the majority live on the campus of the school for the full school year.

Second, third, fourth, fifth, and sixth grade: Refer to the class placements of the children involved in the study. The only criterion for the selection of these children by grades is their placement there by the administration of the educational facility.

Delimitation of the Study

This investigation has been limited in several ways in order to concentrate the study upon basic questions and purposes. The limits operative are:

1. The reading behavior analyzed is that obtained from the reading materials developed for use in the study.

2. The analysis of errors is confined to those which occur in oral reading through the use of braille. The primary analysis of errors is based upon the substitutions or erroneous responses to the stimulus reading materials.

3. The subjects who participated in the study are those children whose grade placements at the time the data were collected were second, third, fourth, fifth, and sixth grade.

4. Only those who read braille by touch (not those who read braille by the use of their remaining vision) are included.

5. Only those subjects who read at least one full paragraph of the stimulus materials are included.

6. Only those whose additional handicapping conditions would not confound the results of an analysis of their reading were included.

7. Only educational facilities within the continental limits of the United States having staff members who expressed a willingness to cooperate in the study are included.

This chapter has indicated that many problems exist in educating the blind, and that very important among these are problems related to reading and teaching

reading in the medium of braille. The specific problem of this investigation has been set forth, and terms used in connection with this study defined. The limitations within which the study has been implemented have been listed. Chapter II presents a review of the literature related to reading in braille and the problem in which this investigation is centered.

CHAPTER II

REVIEW OF LITERATURE

The literature on reading through the use of braille is extremely small in volume by comparison with that on reading in print. It is also relatively small as a proportion of the literature on the blind and their education. Lende (1953), who lists more than 4,000 entries in her excellent annotated bibliographical guide to literature relating to the blind, lists only 97 articles, papers, monographs, and books under the title "Touch Reading." Forty percent of these were written before 1932, when braille was officially adopted.

That literature which is available on this topic is largely didactic or preceptive in nature and has been provided by teachers varying widely in experience, background, and philosophy. These writings appear in a limited number of periodicals for teachers of the blind, in the proceedings of their biennial conventions, or as parts of a small number of texts on the education of the blind. Only two books specifically dealing with reading in braille are known to this investigator. The one by Burklen is dated 1917 and the other by Maxfield is dated 1928. Some descriptive and experimental research has been reported in theses and dissertations. Writings on the development and use of braille as a code comprise one of the larger segments of the literature, but these writings are primarily useful to embossers and publishers, and only secondarily useful to teachers of reading in braille.

This review of the literature is confined largely to the writings that resulted from research and research type efforts, since the didactic writings reveal little pertinent information bearing upon the questions involved in this study.

History reveals (French, 1932) that efforts to provide a system of reading and writing for the blind were recorded as early as the sixteenth century.

However, as French has pointed out, "The universal education of the blind whether as youths or adults occurred to no one before 1784 . . ." Valentin Hauy, founder of the first school for the blind took steps to make such education possible. French wrote, ". . . the invention of embossed printing may safely be said to be the greatest single step in the improvement of the condition of the blind. Credit for the invention belongs wholly to Hauy." However, these early efforts were so strongly directed toward being similar to the inkprint used by the seeing, they were of little value to the blind. As Burklen (1917) put it, "The knowledge that the fingers are the eyes of the blind led early to experiments in making the writing of the seeing tangible for those without sight." Roman letters were minimally interpretable through touch, and since the blind could not reproduce them, they did not provide effectively for the writing aspect of the communication process. It was not until efforts to produce a point or dot type, tangible to the touch and amenable to reproduction by the blind, that significant progress was achieved.

The original point type from which braille was developed was conceived by Barbier (French, 1932), a French military man who was interested in telegraphy. His system was developed as a means of secret communication in the trenches under cover of darkness and was called "ecriture nocturne" or night writing. Barbier's system was introduced into the Paris school in 1821. There Louis Braille ingeniously modified and simplified the system which is now named for him. Barbier's basic punctiform principle and the frame for writing it were retained by Braille.

The literature on touch reading of the blind reveals that the history of reading for the blind has been stormy. While historical records show the origin of touch reading to be traced to as early as 1650, braille in its "final" form, as we know and use it today, did not become the official system for English

speaking countries until 1932. Many blind persons still living have learned as many as three different codes for reading. Furthermore the braille code is still undergoing changes, the latest being published in late 1959 (American Printing House, 1959).

It has been said (Ross, 1951) that "Nothing in the education of the blind was so acrimoniously contested as systems of embossing, until final unification was achieved in 1932." In treating the history of reading media for the blind, authors have entitled chapters "The War of the Dots" or "The Battle of the Types." Some of the best research contributions in the literature on braille as a code have come out of efforts to throw light on the controversy. Though we still find references to this "war," the major battles seem to be over. Loomis (1948) wrote,

> "There is still a marked tendency--and a deplorable one--to blame the system when results are not satisfactory. It is not the braille system, but our methods of presenting it which are questionable. The use of braille is not in an experimental stage; the system itself is no longer on trial."

That progress has been made toward peace in the "war" has been due to the efforts of many. A Uniform Type Committee was established to fulfill the purpose expressed in its title. From its early reports in 1907 to the assumption of its functions by the American Foundation for the Blind in 1923, it studied and reported upon many aspects of the controversy. An early contribution of this commission was a study of dot, cell, and line spacing of braille. Four combinations of spacing were investigated and the dimensions which are used today do not differ significantly from those decided upon in the studies carried on from 1913 to 1920. In these studies, the Committee used the criteria of errors made and speed of reading by the subjects who participated. These studies revealed, from an analysis of the types of errors made, that certain characters in the lower part of the braille cell, especially when standing alone, as in a word sign,

were easily confused with similar characters in the upper part of the cell, such as "but" ⠃ in the upper part of the cell and "be" ⠆ in the lower part of the cell. Similarly, "just" ⠚ and "was" ⠺ ; "go" ⠛ and "were" ⠻ ; "every" ⠑ and "enough" ⠢ ; "have" ⠓ and "his" ⠦ ; and such characters as the sign for "still" ⠌ and "child" ⠉ are confused with the sign for "knowledge" ⠅ . They pointed out that such confusions are accentuated in nonsense sequences of words of the type used in testing the legibility of these signs in various sizes of braille. The average reader, they suggested, is not usually conscious of these confusions because the context may help to correct misapprehension. "There is, however, no doubt that they cause hesitation and confusion on the part of the casual reader," they concluded.

The Committee's studies also showed that certain contractions cause hesitation not only because of their infrequency of recurrence in general literature, but also because of the similarity of the principle upon which they are developed. For example, "work" ⠐⠺ , "word" ⠐⠺ , and "world" ⠐⠺ have a low frequency, and are built from the "w" preceeded by dot five, dots four-five, and dots four-five-six, respectively. The capital sign also causes difficulty with the contractions which are built up by preceeding the character by dot five, as for example, "day" ⠠⠙ , "ever" ⠠⠑ , "father" ⠠⠋ , "here" ⠠⠓ , etc.

Burklen (1917) reported some of his own research and brought together reports on experimental studies of braille by others. His book was translated by Merry (1932) under the title "Touch Reading of the Blind." This work is described as "A psychological study of touch reading, analyzing the process of reading with regard to point size, touch movements, pressure, speed, fatigue, etc." Much of what Burklen reported with regard to braille indicated an interest in psycho-physical aspects of the subject. This fact is no doubt related to the type of interest which dominated psychology in Germany in Burklen's time.

Burklen reported research on the size and spacing of braille dots and cells and upon the legibility of the various dot configurations in the cell. His study indicated that the traditional arrangement of dots in the braille cell, as an upright field two dots wide and three dots high, was psychologically best. Wundt (Burklen, 1917) concurred in this finding, stating that six simultaneous sense impressions seem to be the maximum for simultaneous perception by the senses whether tactual or visual. Burklen found the legibility of braille characters to be dependent upon the pattern of dots more than upon the number of dots in the symbol. Simple geometric patterns were found to be more readable and open characters more legible. As he put it, legibility depends upon ". . . the extension and characteristic form of braille letters . . ., rather than upon the number of dots which appear in them. The relation of the number of dots to legibility, therefore, is negligible." Burklen ran ten experiments on 30 subjects of wide age range and reading ability. His data included 12,000 readings of characters. His experiments utilized braille made of nail heads, embossed on paper, and embossed on tin. The experiments were done on isolated characters, not in context. He established an order of legibility and found ". . . frequent confusions of symmetrical characters . . . ." Ashcroft (1955) in a study of order of difficulty as ranked by experienced teachers, braillists, editors and embossers found lower signs more difficult and geometric simplicity contributive to ease of mastery. Those who ranked the symbols reported confusions similar to those reported by Burklen and others.

Burklen (1917) studied tactual movement and sensitivity and concluded that a reduction in size of braille type below present measurements would have been possible without loss of reading efficiency. It will be remembered that the Uniform Type Committee did not recommend such small dimensions. Recent investigations of braille readability have reopened this question. Meyers and others

(1955) studied the readability of braille as a function of three spacing variables. While these studies failed to produce conclusive results, they suggested that present dot spacing or increased distance between dots was superior to the small dot spacing studied; that present cell spacing or smaller is superior; and that current line spacing proves better than increased line spacing.

Burklen reported that tactual sensitivity was not seriously decreased even after hours of reading. Maxfield (1928), Eatman (1933) and others have supported this view, while the didactic literature frequently mentions concerns regarding the matter of fatigue even in relatively short reading periods.

Burklen concluded that ". . . braille must be regarded as being deficient in the number of its characteristic forms," and pointed out that legibility is reduced since many characters are identical in form with only slight changes in position standing for different meanings. He also noted that ". . . increasing difficulties in comprehension are associated with the changing images resulting from directions of the different touch movements." From his study of braille reading rate, Burklen concluded that the seeing read print three to four times faster than the blind read braille.

Burklen (1917) conducted research on the factor of the touch process in reading. For this purpose, he attached a "tastschrieber" to the reading finger. The tastschrieber was a marking device attached to the finger so as to inscribe a line on paper during experimental reading periods. The device was developed to reveal the type of touch movements used by experimental subjects as they read. He reported that punctographic characters are comprehended only when the fingers are moving across them, not while they are still and applying only static pressure. Burklen concluded that the more straight and even line was characteristic of the better reader, that reading can be done with any finger and with either or both hands; that the pressure of light, even touch characterized the better readers.

Of all the studies and writings in the literature on touch reading, those of Burklen are most pertinent to the present study. It is interesting to note that, although Burklen's work has been available since 1917 and has inspired some research and experimentation (notably that of Holland, Eatman, and Fertsch), little has been done to apply the very significant findings nor to follow them up with further research.

The contributions of Burklen bearing most directly upon the current investigation concern his observations on the characteristics of braille which contribute to errors in reading. In discussing the characteristics of braille symbols, he said that braille ". . . is far inferior to the print of the seeing . . ." The few elemental forms of which braille is composed and the limited number of combinations which a six point field permits allow only a very restricted range; ". . . in the braille alphabet, with the exception of the characters for "k" ⠅ , "l" ⠇ , "x" ⠭ , "y" ⠽ , and "for" ⠿ there are only those characters which, having the same shape, differ from one another according to change of position. Among these, he pointed out, are twenty-six which are symmetrically contrasting or "mirror characters." The characteristic forms among these are as follows: "a" ⠁ , "c" ⠉ , "e" ⠑ , "ch" ⠡ , "m" ⠍ , "s" ⠎ , "o" ⠕ , "p" ⠏ , "r" ⠗ , "n" ⠝ , "t" ⠞ , "g" ⠛ , "b" ⠃ . These 18 forms, which are characteristic because of the number, extension, and position of the dots, compose only about one third of the fifty-one characters in the braille system. Therefore, braille must be regarded as being deficient in the number of its character forms. ". . . and causes more errors in reading on account of its great number of similar characters." Burklen in these comments was, of course, referring to an early version (extant in 1917) of braille and was dealing with braille as it was used in Germany. To apply his early thinking to present day braille, we translate his symbols to their English equivalents, and deal with Standard English Braille,

which is comprised of 63 single cell symbols.

Burklen pointed out that the concept of every letter (symbol) was conditioned by the number of dots, their distance from each other, their position, their extension and their geometrical form. He noted that these characteristics were partly favorable and partly unfavorable to the legibility of the character. These influences were not recognized easily because of the complexity of their mutual activity, and their importance in touch reading cannot be evaluated easily. Burklen was one of the first to state that after braille reading has been learned, the dots are no longer considered, but attention is concerned with recognizing the symbols as a whole, as characteristic touch images. Burklen, discussed the relative legibility of the characters in braille as has been indicated, and presented a rationale for the differences in legibility of the characters. He stated that the easier perception of the characters such as "m" ⠍ , "u" ⠥ , "sh" ⠩ , lay in their heterogeneity; the great difficulty in the characters "f" ⠋ , "h" ⠓ , "d" ⠙ , lay in the more homogeneous arrangement of the dots in their relation to each other. Therefore, open characters (with dots wider apart) possess a better legibility than similar ones with dots closer together. Only those closed characters, he claimed, such as "g" ⠛ , "l" ⠇ which show quite simple geometrical forms have an advantage perceptually.

Maxfield (1928) wrote a book in this country to give suggestions for improvement in reading instruction and to serve as a handbook for teachers of blind children. She stressed that children must be taught to think of wholes before they do of parts, and recommended suspended judgment on the parts of words and units of thought in braille reading. She drew heavily from the 24th Yearbook of the National Society for the Study of Education for her orientation and emphasized readiness, motivation, enrichment, measurement and evaluation. She recommended methods of teaching reading to the blind on what was known about the reading of

sighted children. Maxfield also drew heavily from the Uniform Type Committee's reports in making suggestions about the physical mechanics of reading braille. Maxfield used the Gray's Oral Reading Check Tests in braille and found the average number of errors made by the blind similar to that for seeing children of the same grade level. However, the blind children were over age for grade and read at rates about one third those of the seeing. Maxfield also reported results from the Stanford Achievement tests and found about 60% to be retarded two years or more in reading achievement in relation to chronological age.

Merry (1932) studied the early introduction of contractions to beginning braille readers. Two groups of young children, just beginning to read braille and fairly comparable in mental ability (test not specified) and degree of remaining vision, participated in the study. Children with mental levels under six year were excluded. An equal number of boys and girls were included. The experimental group was taught grade one and one half while the control group was taught braille grade one. Lessons were taught 30 minutes per day and interteacher methods were controlled. The teachers reported daily on the content of their reading lessons. Records were kept of the percentage and types of errors made. The analysis of errors revealed this descending order of frequency: (1) nonrecognitions; (2) substitutions; (3) omissions; (4) insertions; (5) mispronunciations; (6) repetitions. Nonrecognitions and substitutions constituted 95% of the errors by both groups. Speed of reading was greater for the experimental (using contractions) group. Accuracy was better for the control group. The experiment was continued with the Gray's Oral Reading Check Tests, Sets I and II. Again, nonrecognition and substitutions comprised the largest number of errors. Speed of reading was greater for the experimental group, while accuracy was better for the control group, but the differences were not statistically significant. A check after three years showed the experimental group to read faster

and more accurately and it was concluded there were no adverse effects on spelling (a criticism often made of the use of contractions in reading of braille). Merry concluded that the early introduction and teaching of contractions promoted speed and in some cases accuracy, and that the errors by all children showed the need for earlier, more intensive drill in phonics.

Holland (1933) studied good and poor braille readers to compare their techniques of reading. He found better hand and finger movements, few retracings, shorter time spent on getting back to the beginnings of new lines (return sweeps) and more consistent, lighter touch in good readers as compared to poor readers. He advocated the motion-picture-camera method later used by Fertsch (nee Eatman) to record the physical movements of blind persons in reading braille. Holland (1934) also studied the relation of pressure to speed in reading braille and found that those who used lighter more consistent pressure read more rapidly.

Doraiswamy (1934) endeavored to analyze braille reading difficulties among children in the primary grades. On a total of 26 children in the first three grades, he used the materials of the Durrell Analysis of Reading Difficulty transcribed in Grade I braille (full spelling, uncontracted). This investigator concluded that third grade children had more difficulty reading than did those in the other two grades, and recommended the use of the Durrell approach to analysis of reading difficulty. He found prevalent, as reading difficulties among the grades studied, such problems as are covered in the Durrell check list; occasional phrasing, laborious and poorly organized response, monotonous tone, poor enunciation in the case of difficult words, small "finger" vocabularies, poor recall, inadequate word mastery skills, head movements, frowning, signs of tenseness, and poor posture. Frequently-noted problems in silent reading were whispering, lip movement, many upward and downward finger movements, and pressing hard on the braille characters.

Overbeay (1938), in a critical study of braille, proposed revision of the braille code on the basis of the frequency of appearance of signs, abbreviations, and contractions. He recommended a reassignment of meanings of braille characters on the basis of the frequency of appearance by word counts and the amount of space saved.

Niday (1939) conducted a nationwide survey of braille reading in speed and comprehension. His data included test results on 2538 braille readers from grades three through 12 in 39 residential schools for the blind and 11 special classes in day schools. Monroe's Standardized Silent Reading Tests of speed and comprehension were used to determine whether or not the pupils of the Ohio school for the blind were reading as well as pupils from other schools throughout the country. Niday also sought implications as to the best methods of teaching braille reading. He concluded that sighted children read about two and one half times as fast as students in schools and day classes for the blind. Blind children understood more of what they read than did sighted children, the latter reading twice as fast but understanding only about 20% more. Niday found pupils in schools for the blind are retarded an average of about three years as compared to sighted children of comparable grade placement. Hayes (1941) has criticized this study for inaccuracies in the timing of the tests for the blind, but the comparison of rates of reading and differences in achievement are similar to such comparisons by others. Niday found no significant differences in rate or comprehension between residential and day school braille readers. He also found no differences he could attribute to regional or geographic factors. He concluded that some finger readers take up braille very quickly, that girls have better scores than do boys; that girls' rates varied from two to 18 words per minute faster than boys' rates, and that girls comprehend from .60 to 2.10 points higher than boys in the same grades. The boys and girls had read braille for about the same

number of years, but on the whole the girls had better scores than did boys.

Fertsch (1942) pursued studies similar to those of Burklen, but in her study of physical mechanics of reading she used the more modern instrumentation of the motion picture camera, in contrast to Burklen's tastschrieber. Studying the silent reading habits of 143 blind children in grades three through eleven, she found that third graders read material within their comprehension level as well as readers in the eleventh grade reading material appropriate for them. She concluded that by the time children reached the third grade, reading habits had become established, and did not change noticeably with increased reading experience. Fertsch found significant differences in the speeds of silent and oral reading, silent reading being more rapid. The hands of good braille readers moved independently of each other in making regressive movements. Using both hands together to make regressive movements was a distinguishing characteristic of poor readers. She found from her study of return sweeps that independence in the functioning of the hands was a characteristic of good readers, but that, on the average, six to seven percent of reading time was lost in making return sweeps.

The degree of remaining vision, she found, was a factor associated with achievement in reading. Children with less remaining vision tended to read better than those who had more. The variable implied to be operative was attitudinal. Personal commitment to reading through the use of braille seemed stronger in those with less vision. Fertsch measured the speed and accuracy of tactual identification of simple objects, a test of what she called "stereognostic speed, " and found it unrelated to braille reading rate. No relationship was found between finger sensitivity and the speed of silent reading. Person whose hands shared equally in the reading task were found to read more rapidly than those who depended on one of the hands even though they used both. She also

concluded that those who were dependent mainly on the right hand were faster readers than those dependent on the left hand.

Lowenfeld (1945) studied talking book versus braille reading. He compared speed and comprehension of braille and talking book reading and noted the preferences of the children for the two types of reading. Test lessons were prepared and presented in braille and on talking book records with sound effects and dramatization. Comprehension was measured with multiple choice questions. The experimental and control groups used in the study were comprised of 481 pupils of grades three through seven. The rate of braille reading was found to be about one third of the rate of talking book reading. For the seventh grade, the median rate of braille reading was 62 words per minute while the talking book rate was 180 words per minute. The silent visual rate for similar materials, Lowenfeld said, was approximately 220 words per minute. The talking book proved significantly superior to braille as a reading medium at the third and fourth grade level. At the sixth and seventh grade level, no significant differences in comprehension were noted. On the other hand, comprehension for text material in braille was significantly better. Sound effects and dramatizations added greatly to children's pleasure, but did not improve their comprehension. Lowenfeld recommended that instruction in braille should be improved, with more emphasis on speed and comprehension. He also recommended the early introduction of grade II braille and the use of the talking book as a supplement in reading, particularly in the case of those with low intellectual ability. He advocated the use of sound effects on talking books for illustrative purposes.

Hooper (1946) studied 21 series of reading books, some of which were transcribed in braille for children's reading. From an analysis of 13,000 words, she sought to ascertain when the braille contractions of grade II braille would first appear in children's literature and their frequency of appearance in this

material. Her data indicated that the majority of signs, abbreviations and contractions of standard English braille, 144 of the 185, were employed in the reading vocabularies of children in the first school grade. Seventeen of these contractions were introduced in the second grade, five in the third, six in the fourth, three in the fifth, and five in the sixth grade. The remaining five (braille, conceive, conceiving, oneself, and thyself) do not appear in children's literature through the sixth grade. All but 19 of the contractions are met by the end of the third grade. Of the 185 contractions, 152 represent words in the first 1,000 of the Thorndike list.

Langan (1950) reported opinions of teachers of the early introduction of grade two braille. Teachers from eight midwestern schools for the blind contributed data for a comparison of grade one and grade two braille reading. All eight schools reported results favorable to the early use of grade II braille, but continued to disagree on the relative value of the phrase or word method; the level at which grade II braille is best introduced; whether to eliminate the progression from grade one through grade one and one half, and then into grade two; whether or not the primers used were appropriate because of the pictures in the inkprint texts from which they were transcribed; and when to teach braille writing. In spite of the inconclusiveness of this study, it is of interest that virtually all of the schools and classes in the nation have moved to the sole use of grade II braille, and the major source of braille books, The American Printing House for the Blind, now produces school texts exclusively in grade II braille.

Summary

The review of literature indicates a paucity of research and experimentation bearing on reading through the use of braille. This may be true to a large extent because of the relatively small numbers of children involved in the problem, the geographic scatteredness of the programs, and the diverse nature of the types

of educational provisions made for these children. It seems also due to the protracted "war of the dots;" to the fact that braille has been fully accepted only since 1932, and that even since then such issues as the grade of braille with which to start children's reading has been a matter of debate.

The literature that is available and has been reviewed indicates an interest in braille as a code and a medium for reading and writing. It indicates an interest in the space-saving features of the code and in its orthographic usage as a publishing and communication medium. It was issues like these over which the war of the dots was fought, and from which result some of the best information to date on the frequency of appearance of braille usages.

As the review also shows, much of the interest of investigators in matters concerning braille is centered in the physical mechanics of reading in the medium of braille. Physical mechanics are extremely important to reading braille, for in part it is a tactual-kinesthetic process. However, the more important aspect of the problem would seem to be the accurate apperception of ideas from the printed page. No matter how good the mechanics of reading, if errors plague the reader, he can be neither efficient nor effective in obtaining ideas from his reading.

A small number of studies have been cited and reviewed which bear more directly on the type of problem in which this investigation is concerned. These studies indicate that various kinds of confusions in getting meaning from braille symbols confound the reading process. The Uniform Type Committee found, as has been noted, confusions arising from changes in position of similar shape, confirming the work of Burklen. These studies also show that the low frequency of appearance of some forms may cause difficulty and that multiple cell contractions cause special difficulties. These studies, some now more than 35 years old, were concerned with the problems as they related to words in isolation, rather than in the relatively more meaningful context of actual reading material. A further

limitation on the current usefulness of the findings of these studies is the fact that they dealt with an intermediate "grade" of braille, grade one and one half, which contains only 44 contractions, while today, the use of grade II braille, using 185 contractions, is virtually standard practice in the United States. Finally, most of the studies of this type were carried out with adults rather than children. It seems imperative to study children's reading behavior in these connections for the light it can throw on the educational programs which are being implemented for them.

As many of the studies reviewed have indicated, the rate of reading in braille is very slow by comparison with the reading of print. Much of this slowness is attributable to the distance which the fingers have to travel (one quarter inch per character) and the attendant considerable bulk of braille reading materials. The slowness is also due to the loss of time in making return sweeps and in necessary retracings which reflect inaccurate or delayed perception of meaning from the braille. Now, with more and more blind children being educated with seeing children, this handicap in rate and accuracy reading must be reduced.

In chapter III are presented the methods used in the preparation of materials and the procedures followed in obtaining the data of the study.

CHAPTER III

MATERIALS AND PROCEDURES

The review of the literature and research reveals that little information is available on the braille reading behavior of children. The information which is available was often obtained on the reading of grade one and one half braille, on reading by adults, or in studies not primarily concerned with the identification of errors in the reading of children in elementary grades. It was, therefore, considered appropriate to develop suitable reading materials and objective methods for recording erroneous reading behavior for analysis.

The purpose of this chapter is to describe the reading materials, how they were developed, and the procedures used for recording the information pertinent to error analyses. The characteristics descriptive of the children who participated in the study are also presented.

The Preparation of Test Materials

In order to study oral reading errors in braille, appropriate stimulus materials in braille were required to elicit samples of reading behavior from the children who were to be the subjects of the investigation.

It was first assumed that existing oral reading test materials for seeing children might be utilized if transcribed in braille. Analysis of these test materials indicated that they were not such as to involve the signs, abbreviations, and contractions of the braille code in a way that would elicit data for a comprehensive analysis of braille reading errors. Among the tests analyzed were: The Durrell Analysis of Reading Difficulty by D. D. Durrell (1937); the Gates Reading Diagnostic Tests, revised by A. I. Gates (1945) and Gray's Standardized Oral Reading Check Tests and Gray's Standardized Oral Reading Paragraphs Tests, by W. S. Gray (1915).

Since, upon analysis, these tests appeared to be unsatisfactory for the purpose, simple reading materials of the type used as supplemental readers for the primary grades were examined and tried out. It was impossible to locate such materials which in a short context had adequately represented the features of braille to be tested for. Furthermore, the interest level of such materials would have been inappropriate for children in the later grades studied, and there could be no assurance that the potential subjects to be included in the investigation had not already read such previously published materials. There seemed to remain only the alternative of constructing materials specifically for the purpose of the investigation. Such preparation was undertaken in the way here described.

The signs, abbreviations, and contractions essential to the braille code constituted a list of 185 different words and signs to be included in the reading test material. The publication, A Manual of Standard English Braille (Library of Congress, 1953), was taken as the authority in this connection.

Assistance in the construction of suitable paragraphs was sought from a number of readers of braille and competent individuals professionally engaged in teaching reading in braille, editing materials for publication in braille, or in transcribing print materials into braille. These individuals were asked to rank braille signs and contractions according to difficulty, and to make suggestions for the construction of paragraphs. Results were obtained from 33 such individuals. On the basis of the suggestions and the rankings accorded to the braille symbols (on a scale of one or no difficulty to six or very difficult), average composite ratings were computed and the signs and contractions were ranked in order of the ratings from easy to hard.

The words represented by word signs, such as "for" ⠿, "as" ⠵, "it" ⠭, and "and" ⠯ were evaluated for the difficulty in children's reading vocabularies by use of the Thorndike Teacher List of 30,000 Words (1944). The data in this

reference result from counts of approximately four and a half million words and combine the excellent work of Lorge and others with that of Thorndike. This reference became the authority upon which were based decisions regarding placement with respect to difficulty and usefulness in the construction of meaningful, interesting short stories.

When appropriate words had been chosen to "test for" the signs and contractions, they were combined with words for which the braille code prescribes abbreviations such as "ab" for "about" ⠁⠃ , "yr" for "your" ⠽⠗ , "ac" for "according" ⠁⠉ , and "imm" for "immediate" ⠊⠍⠍ and the resulting list of 209 words was supplemented by 227 simple words necessary to construct meaningful yet concise texts. The 436 different words utilized resulted in the use of 1039 words for the graded series of twelve paragraphs.

Three criteria were established to guide the construction of the stories. First, it was required that each paragraph should be a complete, interesting, and meaningful short story in itself. Second, it was required that the readability of each paragraph should be controlled (in so far as feasible while including all the signs, abbreviations, and contractions of braille) for the lowest possible grade of readability that would retain meaning and interest. Third, it was required that the criteria used for the appraisal of readability should be the criteria of authorities in the determination of readability. Dolch's Graded Reading Difficulty Work Sheet, Revised, 1954, and Flesch, (1951) provide the formulae used while guidance was obtained from the work of Gray (1947), Chall (1947), Lorge (1944), Thorndike (1944) and others. Table 1 shows the readability and reading ease scores obtained by application of the Dolch and Flesch formulae.

Though the recommendations for controlling readability were given careful consideration and implemented in so far as possible, some of the principles were violated in the interest of providing for coverage of common braille usages and

Table 1

Characteristics of Paragraphs

Par. No.	No. of Sentences	Type of Sentences			No. of words	Avg. No. words per sentence	No. of syllables/par	Av. wd length syl'ble	Dolch Formula				Flesch Reading ease Score
		Simple	Complex	Compound					Sent. rdg. grade	Long sent. rdg.gd.	Hard wds. grade	Avg. grd. level	
1.	7	7	0	0	53	7.6	59	1.1	1.5	1	1	1	106
2.	9	8	1	0	52	5.8	59	1.1	1.0	1	3	1.	108
3.	9	9	0	0	74	8.2	88	1.2	2	1	1	1.3	97
4.	9	6	3	0	67	7.4	84	1.3	1.5	1	1.5	1.3	89
5.	8	7	1	0	73	9.1	92	1.3	2	1	1	1.3	88
6.	19	15	4	0	126	6.6	163	1.3	1	1.5	2.5	1.7	90
7.	14	9	5	0	121	8.6	152	1.3	2	2	3	2.3	88
8.	11	9	2	0	82	7.5	111	1.4	1.5	1	5	2.5	81
9.	13	9	4	0	106	8.2	131	1.2	2	1	5	2.7	97
10.	7	3	3	1	78	11.1	105	1.3	3	4	6	4.3	108
11.	7	2	5	0	82	11.7	121	1.5	3	3	6	4.0	68
12.	10	5	4	1	125	12.5	164	1.3	3	5	6	4.7	84
Totals	123	89	32	2	1039	8.4	1329	1.3	2.04	1.6	3.4	2.4	92

the enrichment of content for interest purposes. It should be noted also that one point of concern in this investigation was the appropriateness of the application of readability formulae of the type utilized and referred to in the appraisal of materials transcribed into braille. It seems logical and appropriate to question the acceptance at face value of a readability index determined on print materials as an appropriate index of readability of the same material in braille. Such factors as the use of multiple-cell contractions, the extreme abbreviations of words, the utilization of punctuation signs that have multiple meanings depending on context, and other factors may have tended to alter the difficulty index in ways which needed investigation. A careful search of the literature on braille and reading in this medium reveals no research of this nature. However, as an expedient effort to control readability, existing formulae were used in unmodified form to determine the readability of the materials used as stimulus in the investigation.

A trial set of paragraphs based on the considerations presented was prepared. These paragraphs were tried out with 30 braille reading children of the Kentucky School for the Blind. They were also presented to teachers for criticism and suggestions. On the basis of the results of these efforts, the paragraphs were revised and a final braille grade II form was prepared in accordance with the accepted publication standards of the American Printing House for the Blind. The paragraphs used are as presented in Appendix I.

Procedures

The investigation as originally conceived was planned to obtain data on the braille reading behavior of a very large sample of the blind children enrolled in the educational facilities of the United States. To this end, the cooperation of most of these facilities was sought. The investigator himself sought to obtain as much of the data as possible and to supplement these data with those of

cooperating investigators. Appendix H, Braille Reading Mastery Study Background Information and Instruction, contains a sample of the materials used to inform and instruct the cooperating persons. The following procedures were implemented.

Children in the second, third, fourth, fifth, and sixth grades were identified and asked to read the materials. The investigation was concentrated upon the populations of the second, fourth, and sixth grades, but data were obtained also from third and fifth grade children so that trends through the grades might be considered.

Each child was tested individually in a quiet and comfortable setting for oral reading. Attempts were made to allay any fears the children might have had in such a setting by chatting about things of interest to them and by establishing a comfortable, pleasant working relationship with each subject. After adequate rapport had been established, the following instructions were read:

> We're trying to find out how children read some short stories. We'd like you to help us with it. I'd like you to read these stories aloud for me. Some are easy and some are harder. You may not know all the words, and you're not expected to know all of them. Just do the best you can. I'll help you if you get stuck on a word after you've tried to read it. Take all the time you need. I'm going to time you with a watch, but do not rush. It's better to get the words right than to hurry too much. Here's the first "story".

As each child read from his braille copy of the test materials, the investigator followed these procedures: Above each word that was not read precisely as it should be, the exact expression of the child was recorded on an inkprint copy of the test materials. If the child automatically corrected himself, a small "c" was recorded after what was written. If the child hesitated on a word, a wavy line ~~~ was marked under it. If, after hesitating the child miscalled the word, the error was recorded exactly with phonetic spelling. If the child hesitated so long (five seconds or more depending on the child's natural rate) that the examiner was sure he did not know the word, the child was asked to spell it. The resulting spelling was recorded exactly. If the spelling did

not result in a spontaneous grasp of the word, the child was helped with it, a wavy line for hesitation was marked, an SP for "spelling" and a WA for "word aided" was recorded. If the child asked what a word was, a "?" was marked for a question, he was asked to spell it, the spelling was recorded, and SP was marked to indicate this. If the child still failed to get the word, he was helped with it and the record form was marked WA. If the child tried a word and said, "Is that right?," a "Q" was recorded and if he was correct, a "c" was recorded. If the response was incorrect, the word was recorded as stated and the child was helped, the examiner marking WA. If the child omitted a word, syllable, or letter, it was encircled. Additional words the child provided were recorded and the place at which they were inserted was indicated with a caret (^). If the child repeated a word or phrase one or more times, it was underlined as many times as it was repeated--one line for one repetition, two lines for two, and so forth. An example of the recording of errors is included in Appendix I.

Each child started reading paragraph one and read successive stories until he made ten or more errors of the type mentioned above, except for repetitions. The elapsed time of reading each paragraph was recorded in minutes and seconds. Following the reading of each paragraph, the child was asked the reasons for any hesitancies and these were recorded. Cooperating examiners were asked to provide any additional comments they felt were needed to convey just what they meant by remarks on the reading performance of the children they saw.

In addition to the reading behavioral data that were obtained on each child, a number of types of information were obtained to help in the interpretation of the behavioral data. See Appendix I. The first, middle, and last names were obtained. Sex was recorded. Remaining vision was described. Facts about reading history were listed. Teacher estimates of intelligence, motivation in school work, quality of previous performance in braille reading, and in other school

subjects were noted on the information blank.

An evaluation by teachers was obtained regarding each child's adjustment to school life in general. Additional handicapping conditions were noted and described. The test date, birth date, current grade in school, years in school, and years instruction in braille were recorded. At the conclusion of the reading session, any unusual factors present in the reading session were noted. Adjustment to the reading session was noted and the motivation to do well was evaluated. Where information was available regarding previous reading performance, a comparison with the test session was made. The interest and difficulty of the material were evaluated, and the greatest difficulties of the children were noted. General comments were made on rapport, motivation, performance, and the other factors previously noted. These descriptive and behavioral data which are useful in the understanding and interpretation of the reading behavioral data are summarized in Appendixes A to E.

Characteristics of the Subjects

More than 728 children participated in the study. Data have been analyzed for the 728 children who read at least one full paragraph, who were in the second through the sixth grades, who did not have some additional handicapping conditions that would significantly affect their reading behavior.

Appendix A presents data descriptive of the chronological ages of the subjects by grades, sex, and type of educational placement in which they were. The table indicates, for example, that there were 204 second graders ranging in age from six years seven months to fourteen years six months with a median of eight years nine months. The table shows that there were 113 boys and 91 girls at this grade level and indicates the number of each that were in day school programs and residential school programs.

Appendix B shows how intelligence was rated for all the readers by grade,

sex, and educational facility. More than 80% of the children were ranked by their teachers as average or above in intelligence. Day school children were rated higher and less variable as a group than were children in residential programs. Day school girls tended to be rated higher than their male counterparts, but residential program girls were rated somewhat less bright than boys.

Less than one percent of day school children were rated very dull while 2.7% of residential children were so rated.

Appendix C shows braille reading experience in years of school by grade, sex, and educational facility. Residential school children tended to have had more experience in reading in braille than did children in day schools. Girls had less experience than boys. Second graders tended to have more than the expected experience for their grade, but the trend in the grade groups was toward having less than the expected experience. This is accounted for by later onsets of blindness in some children in later ages and their having therefore, reading experience divided between print and braille.

Appendixes D and E show the motivation and interest ratings of the readers with regard to the reading material. Girls were rated as having higher motivation than boys and older children were more highly motivated than younger. Girls were rated as having higher interest than boys and older children were more interested in the materials than younger children.

Appendix F indicates that about one third of the reported U. S. residential school enrollments in the second, fourth, and sixth grades participated in the study. About one fifth of the day school enrollments for the same grades participated.

CHAPTER IV

FINDINGS OF THE STUDY

The preparation of materials, the procedure, and the characteristics of the subjects have been described. It has been indicated that 728 children provided data for analysis of oral reading behavior. The data for analysis in the study are comprised of the oral reading errors produced by these children in reading the paragraphs which were prepared for the purpose. These error data, obtained in individual test settings, were recorded on test record blanks, and data from each test protocol were transferred to error-tabulation word cards which were prepared for each of the words in the paragraphs. On these cards were recorded all the errors associated with the particular word.

The 728 children read 6,433 paragraphs containing 543,065 words in all. Table 2 indicates, by grades, the number of paragraphs and words read.

Table 2

Number of Children by Grades and Material Read

Grade	Number of Children	Number of Paragraphs Read	Average Number Paragraphs	Number of Words Read	Average Number of Words Read
2	204	1022	5.0	85,364	418
3	53	458	8.6	37,696	711
4	211	2047	9.7	171,270	812
5	62	682	11.0	58,258	940
6	198	2224	11.2	190,477	962
All	728	6433	9.4	543,065	746

The 728 children, in reading the 543,065 words made a total of 29,112 errors on all types. Errors, for the purposes of this study, were broadly defined as has been indicated in Chapter III. The errors included everything that could be defined as a slight difficulty with the content, context, and mechanics of the paragraphs. The errors may be conceptualized as comprising a continuum of difficulties ranging from slight hesitations (indicating momentary difficulties) to the grossest of breakdowns in the reading process reflected by random, meaningless responses comprised of guesses at words showing little relationship to the reality of the embossed symbols. This continuum may be illustrated in the following way; slight hesitations -- longer hesitations -- rising inflections indicating questions -- substitutions spontaneously corrected -- erroneous substitutions allowing satisfactory continuation -- erroneous substitutions and "I don't know" responses interrupting the reading process. The point to be noted in connection with this suggested continuum of errors is that the error total, 29,112, is not a homogeneous group of errors of equal import for analysis of difficulty in reading in braille. Yet, all of these errors contribute to an understanding of the problems entailed in reading in this code.

The error-tabulation word cards were grouped in categories according to the type of braille orthography prescribed by the braille code for their presentation. Seven categories were utilized for this purpose.

Category I words were those which are transcribed in full spelling, or letter for letter, in braille (one braille character for each print letter, as the word "write", w r i t e .

Category II words were those in which a braille alphabetic character standing alone represents the complete word (for example, "k" stands for the complete word "knowledge").

Category III words were those in which symbols called "upper contractions" (because they contain dots in the upper part of the cell) represent part of the word (for example, the "ed" sign ⠫, which stands for "ed" wherever it appears in a word, such as "worked" dot 5, w-ed ⠺⠫.

Category IV words were those in which lower contractions (because they contain dots in the lower part of the cell) represent part of the word (for example, the "en" sign which stands for the letter combination "en" wherever it appears, such as in "even", e ⠑ v ⠧ en ⠢).

Category V words were those whole and part word contractions made up of two cells (for example, the sign for "work", dot five w ⠺, or dot five in one cell preceeding the letter "w" in a second cell, which may stand together for the word "work", or may appear as a part of a word as "working" ⠺⠬.

Category VI words were those abbreviations as prescribed by the braille code, (for example, the letters "imm", written together as "i" ⠊ "m" ⠍ "m" ⠍, stand for "immediate"; "bey" ⠃⠽ for beyond, and "pd" ⠏⠙ for paid.

Category VII words were those words made up of combinations of the other six types of orthography, (for example, "worked" contains a Category V contraction, dot five w ⠺ for work, and "ed" sign ⠫ for "ed" to make up the word "worked".

It was these seven categories into which the words were grouped for error tabulation and for later error analysis.

Table 3 indicates the proportion of words in each category, and the percentage which they comprise of the total number of words; the number of errors associated with the category, and the percentage which those errors comprise of the total number of errors.

These data indicate that Categories I, II, III, and IV contribute 74.3% of the words, but the errors associated with these words make up only 53.8% of the total of the errors. Categories V, VI, and VII contribute 25.7% of the total

words, but the errors associated with these words make up 46.3% of the errors. That is, about one fourth of the material constituted the basis for nearly 50% of the errors. In the case of each of the categories I through IV, the contribution of the type of word is greater than the contribution of errors that might be expected from the category if they were all equally likely to produce errors. In the case of each of the categories V through VII, the contribution of the type of word is less than the contribution of errors that might be expected of the category.

Table 3

Comparison of Contributions of Words by Type and Errors

Type of Word (Category)	Total Words	Percentage of Total Words	Total Errors	Percentage of Total Errors	Difference*
I	212	20.4	4156	14.3	- 6.1
II	179	17.2	2584	8.9	- 8.3
III	251	24.2	5685	19.5	- 4.7
IV	130	12.5	3217	11.1	- 1.4
V	104	10.0	5099	17.5	7.4
VI	110	10.6	6259	21.5	10.9
VII	53	5.1	2112	7.6	2.5
Totals	1039	100.0	29,112	100.3	

*Contribution of words less contribution of errors by categories.

The order of difficulty, from easy to hard in terms of errors produced, is Category II, alphabetically abbreviated words; Category I, words in full spelling; Category III, words containing upper contractions; Category IV, words containing lower contractions; Category VII, words made up of combinations of the other types of orthography; Category V, words comprised of two cell contractions; and finally, most difficult, Category VI, words having abbreviated forms

prescribed by the braille code. In the analysis of the findings which follows in Chapter V, interesting aspects of these findings are noted.

Wide variation is apparent in the range of individual and group differences in reading ability of the children and grade groups participating in the study. For this reason, the children read different amounts of the prepared material. In order to have a common base on which to compare errors in view of the different total amounts read, error indices were computed by grade for each word in the paragraphs. The formula for the computation of these error indices was:

$$\text{E.I. (error index) equals } \frac{\Sigma e \text{ (Sum or total number of errors associated with each word)}}{N \text{ En (Number of encounters of the words)}}$$

The numberator in the formula was a sum total of all of the errors recorded for the children in the grades or grade for which the error index was computed. The denominator in the formula was the total number of encounters of the word and was computed from the number of children of the grades or grade who read the word, multiplied by the number of appearances of the word up to the point where the children involved had read.

Six error indices were computed for each word. The first error indices were for all the five grades represented by the children in the study. The other five indices were specific to the five grade levels of children who participated. A complete table of all of the error indices appears in Appendix G.

In computing the error indices, all errors were counted and all appearances for each word were noted. The number of children reading each paragraph by grades was counted. The computation produced an index of the number of errors associated with 100 encounters of the word. The word "play" will serve as an example; the word appeared three times, twice in paragraph one and once in paragraph four. There were 114 errors associated with the word "play". In paragraph one, 728

children read the word "play" twice, giving 1456 encounters and in paragraph four, 634 children read the word once, giving 634 encounters or a total of 2,090 encounters for three appearances. Dividing the number of errors, 114, by the number of encounters, 2,090, yields an error index of .055, or about five and one half errors per 100 encounters. To compute an error index for the word "play" for the second grade readers, it was noted that 50 of the 114 errors were made by second graders. The 204 second grade readers met the word twice in paragraph one, giving 408 encounters, while 131 encountered the single appearance in paragraph four, giving a total of 539 encounters. Dividing the 50 second-grader errors by the 539 second-grader encounters yields a second grade error index of .093, or about nine and a third errors per 100 encounters. By way of contrast and further illustration, 198 sixth graders met the two appearances of "play" in the first paragraph, yielding 396 encounters and 193 encountered the single appearance in paragraph four, giving a total of 589 encounters. Dividing the 14 errors made by sixth graders by the 589 encounters yields an error index of .024. All error indices were computed similarly.

It should be remembered, as noted previously, that the errors dealt with in these connections, do not comprise a homogeneous group with respect to type. For example, an examination of the errors in connection with the word "play" used to illustrate the computation of error indices, shows that the error total is made up of several types of errors. The 50 errors of the second graders include 21 substitutions, four hesitations requiring aid, 20 hesitations not requiring aid, and five miscellaneous errors. The 14 errors of the sixth graders were comprised of 11 substitutions and three hesitations requiring no aid.

Average error indices for the grades by categories of words were computed to determine the order of difficulty among the categories. These averages were computed by summing the error indices for all the words in a category and

dividing by the number of words in the category. Average error indices for the grades by categories of words are found in Table 4.

The order of difficulty represented by the data in Table 3 is maintained in the data on average error indices represented in Table 4 and graphically presented in Graph 1.

The orders of difficulty for grades two and three were identical to each other. The same was true for grades four and five. Grade six differed from the other grades in ranking category I more difficult than category III. The small difference, about 3 errors per 1,000 words read, appeared to be a chance difference. The other minor differences in order of difficulty appeared to be functions of the difference in number of children participating from the third and fifth grades, differences in amounts read, and chance differences of small magnitude.

While the ranks presented in Table 4 are valuable to show the relative consistency of the order of difficulty of the categories among the grades, these ranks tend to obscure facts about the relative magnitude of the error indices as compared among the several grades. A graphic presentation of these data helps to put these indices into perspective. Graph 1 is presented for this purpose.

It merits noting again that the gross totals of errors so far dealt with do not comprise a homogeneous group other than that they have been associated with the specific words for which they have been tabulated and are the products of the reading of children at the same grade levels. While the errors indicated difficulties with the reading matter and provide data having a bearing on the difficulties encountered, they all do not provide material for analysis of the nature of the difficulties as they are relatable to the problems of reading through the use of braille, per se. Of the total of 29,112 errors, 12,108 or 41.6% of them provide data for qualitative analysis with direct relevance to

Table 4

Average Error Indices

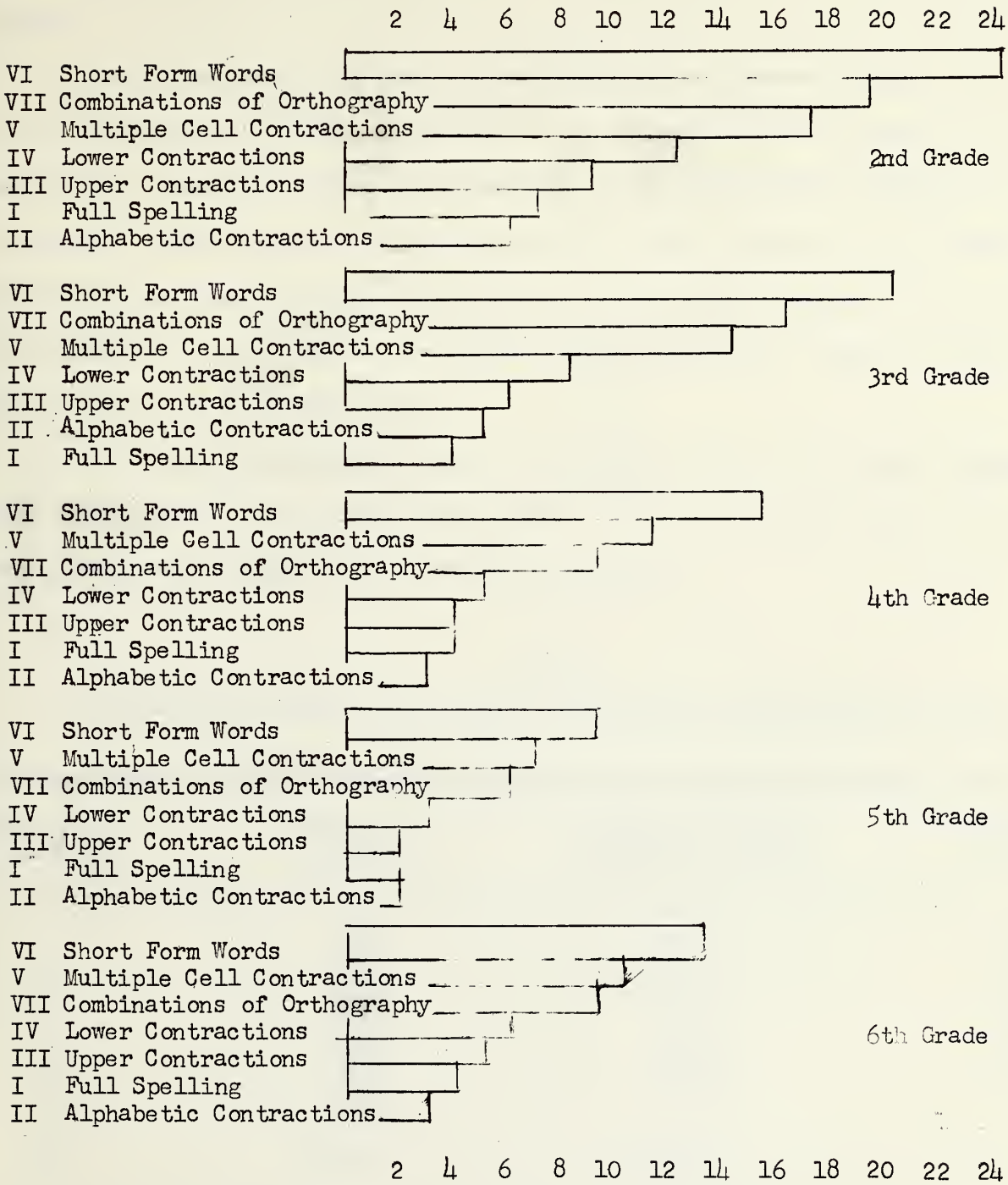
(Based on Total--29,112--errors)

Type of Word (Category)	2nd Grade	R[1]	3rd Grade	R	4th Grade	R	5th Grade	R	6th Grade	R	All Grades	R
I	.07[2]	6	.05	6	.04 (.035)[3]	6	.03 (.032)	6	.02 (.0233)	5	.04 (.037)	6
II	.06	7	.04	7	.03	7	.03 (.031)	7	.02 (.020)	7	.03	7
III	.08	5	.06	5	.04 (.040)	5	.03 (.034)	5	.02 (.0230)	6	.04 (.042)	5
IV	.12	4	.08	4	.05	4	.04	4	.03	4	.06	4
V	.17	3	.14	3	.11	2	.08 (.079)	2	.07	2	.10	2
VI	.24	1	.20	1	.15	1	.12	1	.09	1	.13	1
VII	.19	2	.16	2	.09	3	.08 (.077)	3	.06	3	.06	3

1. R refers to ranking of the problem, one being greatest difficulty and seven being least.
2. The decimal numbers refer to the number of all types of errors per 100 words read.
3. Numbers are shown parenthetically to three places where tied ranks would exist when two places are shown.

Graph 1

Average Error Indices, Magnitude and Rank
(Based on total 29,112 errors)



reading in braille. It is in the analysis of substitutions for words, parts of words, and letters that the most fruitful material is found for an analysis of these difficulties. For this reason, attention was focused upon the substitution errors.

A classification of the errors was undertaken in order to determine the nature of the difficulties children encounter. This classification of errors by type was made by the investigator with the assistance of two experienced teachers of reading in braille. Tabulation and examination of the errors revealed that 31 types of classifications could be made to include all the errors. Analysis of the tabulation indicated that 10,933 of the 12,108 errors classified, tended to cluster in eight of the classification groups.

Table 5 shows the distribution of the 12,108 errors in the seven categories from the standpoint of braille orthography, and the proportion of these errors which were classified in eight error-type classifications.

Table 5

Proportions of Errors Classified in Eight Error-type Classifications

Type of Word (Category)	Substitution Errors	Number in Eight Error-Type Classes	Percentage of Total
I	1651	1430	86.6
II	1523	1453	95.4
III	2501	2276	91.0
IV	1260	1175	93.3
V	2316	2092	90.6
VI	2175	1876	86.3
VII	682	631	92.5
All	12,108	10,933	90.3

Table 6 shows the distribution of the 10,933 errors among the eight error-type groups, and gives the order of these difficulties for all the children in terms of raw error totals.

Table 6

Distribution of Eight Error-Type Groups

Error Group	Number of Errors	Percentage of Errors
Missed Dots	1702	15.6
Ending Problems	1599	14.6
Reversals	1434	13.1
Added Dots	1392	12.7
Association	1358	12.4
Gross Substitutions	1335	12.2
Up and Down Alignment	1140	10.4
Left and Right Alignment	973	8.9
Totals	10,933	99.9

The error-types of Table 6 are ways of describing the behavior of children as they encountered braille reading difficulties and substituted responses which did not conform to the stimulus presented by the words of the text. Missed dots is the case in which for example dot five "f", which should be read "father" was read "from", which is represented by "f" standing alone; or in which dot five "s", which should be read "some" was read "so", which is represented by "s" standing alone.

Ending problems is the error group in which word endings were dropped or erroneously read, the stem of the word only being substituted, or in which a wrong ending was substituted for the correct ending. For example, "coming" was often substituted for "come". Endings like the "ing" were substituted for the "ed"

ending; words ending in "s" were often given without the "s" ending, and sometimes it was added to words in which it did not appear.

Reversal problems is the error group in which characters with mirror images, such as "i" ⠊ and "e" ⠑ ; "and" ⠯ and "y" ⠽ ; "d" ⠙ and "f" ⠋ ; "h" ⠓ and "j" ⠚ ; and many others were substituted for each other.

Added dot problems is the error group in which the response was a substitution resulting from the assumption of the presence of one or more dots in addition to the actual stimulus present to produce an erroneous response. For example, "forget" ⠿⠍⠫⠞ , was read "forgot" ⠿⠍⠕⠗⠛⠕⠞ , "which" ⠱ was read "where" ⠱⠗⠑ and "the" ⠮ was read "there" ⠮⠗⠑ .

Association errors were those in which an erroneous response is associated with a stimulus, usually of the type which in braille depends upon memory. As an example, "al" which stands for "also", is often read "always" (alw); "wh" standing alone, which means "which" was often read "when" (which should appear "wh" sign, "en" sign).

Gross substitutions are those errors which were not classifiable under the other error types. In these, there was no recognizable relationship of the error to any available category.

Up and Down alignment problems were those errors which resulted from giving the meaning which is associated with a dot combination in the upper part of the cell to the dot combination when it appears in the lower part of the cell. For example, "d" ⠙ in the upper part of the cell stands for "do", but in the lower part of the cell "⠒" stands for double "d" (dd), "dis", or the period.

Left-right alignment refers to the type of errors resulting when dots in the left hand portion of the cell are perceived to be in the right portion of the cell. For example, "k" ⠅ was read dots 4-6 ⠸ which is a prefix for a multiple cell contraction.

Table 7

Rank and Magnitude of Error Types by Orthographic Categories

Category I Full Spelling (212 words)		Category II Alphabet Words (179 words)	
Ending Problems	363	Reversals	338
Gross Subs.	294	Added Dots	321
Missed Dots	212	Lest Right Align.	190
Left Right Align.	202	Association	190
Reversals	178	Gross Subs.	165
Added Dots	98	Up-down Align.	142
Up-down Align	51	Missed Dots	82
Association	32	Endings	25
	1430		1453
Category III Upper Contractions (251 words)		**Category IV Lower contractions (130 words)**	
Added Dots	518	Up-down Align.	459
Gross Subs.	427	Endings	185
Reversals	399	Reversals	158
Missed Dots	312	Gross Subs.	111
Endings	305	Missed Dots	107
Left Right Align.	151	Association	74
Associations	115	Added Dots	61
Up-down Align.	49	Left Right Align.	20
	2276		1175
Category V Multiple Cell (104 words)		**Category VI Short Form Words (110 words)**	
Missed Dots	658	Association	465
Association	434	Endings	404
Left Right Align.	251	Up-down Align.	309
Added Dots	229	Missed Dots	189
Gross Subs.	173	Reversals	170
Endings	155	Added Dots	123
Reversals	118	Gross Subs.	116
Up-down Align.	74	Left Right Align.	100
	2092		1876
Category VII Combinations (53 words)		**Category VII (continued)**	
Endings	162	Up-down Align.	59
Missed Dots	142	Gross Subs.	49
Reversals	73	Associations	48
Left Right Align.	59	Added Dots	42
			631

In order to reduce the error totals for the error-types listed in Table 6 to indices that may be compared for grade groups, an error index was computed. For this purpose, the total numbers of words read by all the children and by the children at each grade level were taken as common denominators. Dividing the total number of errors associated with an error type produces a decimal that may be read as the number of the type of errors per 1000 word encounters. Table 8 shows the indices which result for all children and for the children of each grade group for each of the eight error-type classifications. Graph 2 depicts the rank and magnitude of the error by grades.

Table 8

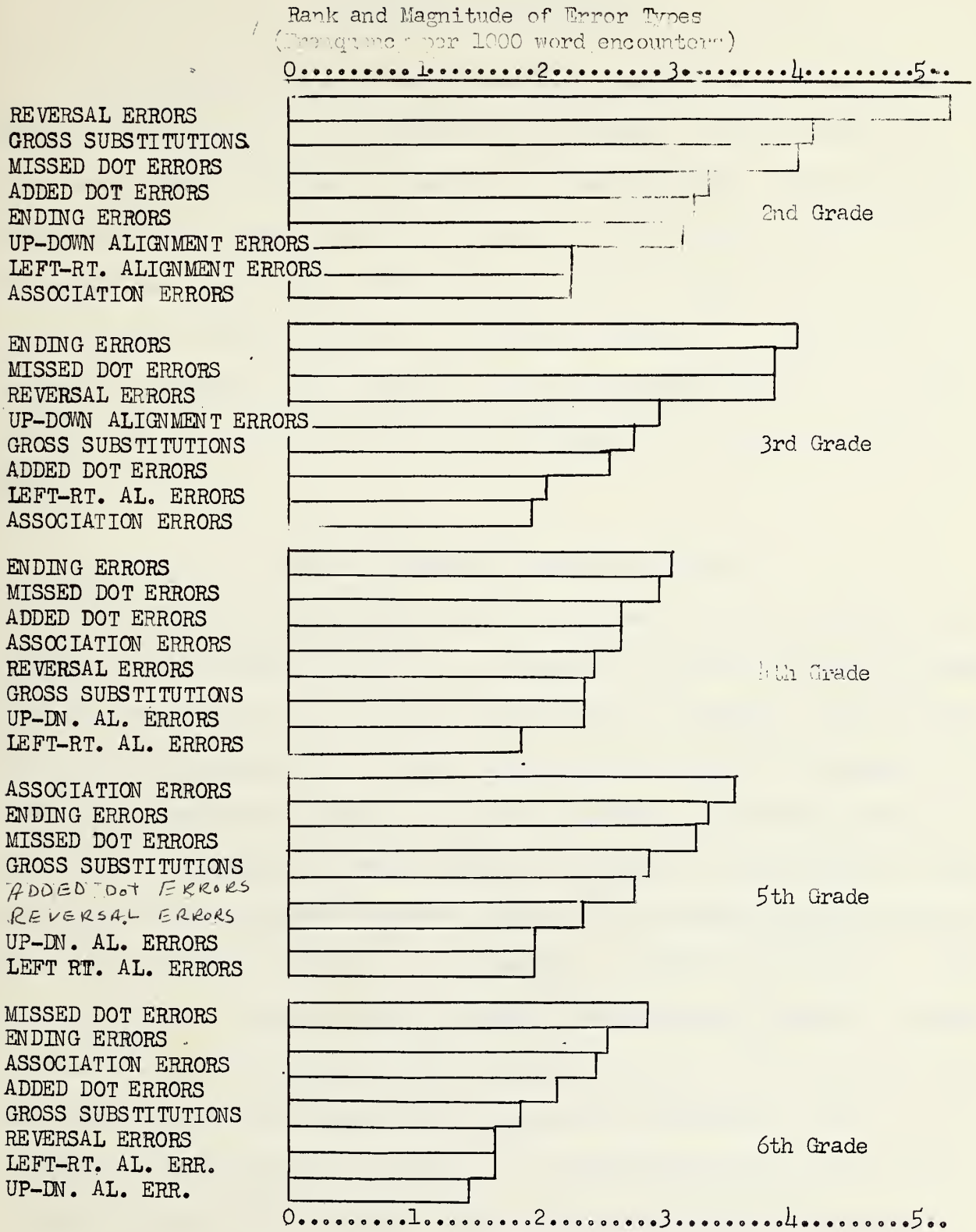
Error Indices for Eight-Error-Type Classifications

(Frequency per 1000 word encounters)

Error Type	All Grades	R	2nd Grade	R	3rd Grade	R	4th Grade	R	5th Grade	R	6th Grade	R
Missed dots errors	3.2	1	4.0	3	3.8 (382)	2	2.9	2	3.2	3	2.8	1
Ending errors	2.9	2	3.2	5	4.0	1	3.0	1	3.3	2	2.5	2
Reversals	2.6 (264)[1]	3	5.2	1	3.8 (377)	3	2.4	5	2.3	6	1.6 (161)	6
Added dots	2.6 (266)	4	3.3	4	2.5	6	2.6 (263)	3	2.7	5	2.1	4
Association errors	2.5 (250)	5	2.2 (215)	8	1.9	8	2.6 (259)	4	3.5	1	2.4	3
Gross substitutions	2.5 (246)	6	4.1	2	2.7	5	2.2	6	2.8	4	1.8	5
UD Alignment errors	2.1	7	3.1	6	2.9	4	2.3	7	1.9 (192)	7	1.4	8
LR Alignment errors	1.8	8	2.2 (220)	7	2.0	7	1.8	8	1.9 (191)	8	1.6 (155)	7

1. Numbers in parenthesis show error indices carried to three places to break ties in ranks when only two places are used.

Graph 2


Rank and Magnitude of Error Types
(Frequency per 1000 word encounters)
0.....1.....2.....3.....4.....5..
REVERSAL ERRORS
GROSS SUBSTITUTIONS
MISSED DOT ERRORS
ADDED DOT ERRORS
ENDING ERRORS
UP-DOWN ALIGNMENT ERRORS
LEFT-RT. ALIGNMENT ERRORS
ASSOCIATION ERRORS
2nd Grade
ENDING ERRORS
MISSED DOT ERRORS
REVERSAL ERRORS
UP-DOWN ALIGNMENT ERRORS
GROSS SUBSTITUTIONS
ADDED DOT ERRORS
LEFT-RT. AL. ERRORS
ASSOCIATION ERRORS
3rd Grade
ENDING ERRORS
MISSED DOT ERRORS
ADDED DOT ERRORS
ASSOCIATION ERRORS
REVERSAL ERRORS
GROSS SUBSTITUTIONS
UP-DN. AL. ERRORS
LEFT-RT. AL. ERRORS
4th Grade
ASSOCIATION ERRORS
ENDING ERRORS
MISSED DOT ERRORS
GROSS SUBSTITUTIONS
ADDED DOT ERRORS
REVERSAL ERRORS
UP-DN. AL. ERRORS
LEFT RT. AL. ERRORS
5th Grade
MISSED DOT ERRORS
ENDING ERRORS
ASSOCIATION ERRORS
ADDED DOT ERRORS
GROSS SUBSTITUTIONS
REVERSAL ERRORS
LEFT-RT. AL. ERR.
UP-DN. AL. ERR.
6th Grade
0.....1.....2.....3.....4.....5..

CHAPTER V

ANALYSIS OF THE FINDINGS

The findings of the study which have been presented in Chapter IV are analyzed in this chapter. For purposes of the analyses, a basic premise and a review of the characteristics of braille are presented first. The analyses then deal with the error data as they were related to the categories of braille orthography that were used. Further analyses deal with eight error types and their relationships to grade levels and orthographic categories. Educational implications are presented in the discussion, along with recommendations for teaching methods, the preparation of instructional materials, and changes in the braille code.

The Basic Premise Underlying Analyses

The analyses of the findings are made in terms of the basic premise that reading, no matter what the medium, fundamentally involves the same psychological processes and has as its purpose the communication of meaning. The literature on conventional reading is in rather general agreement that the minimum essential factors in reading are perception and interpretation. As Hildreth (1958) has pointed out, "Reading is a mental process involving the interpretation of signs perceived through the sense organs." Nothing about braille reading excludes it from a definition of this type. It is evident that the same factors are essential in reading in braille and the problems encountered are therefore, similar in nature to those found in any other reading behavior. What differences there are, lie largely in the differences in modality of perception, that is, touch in contrast to vision; and in medium to be interpreted, that is, dot symbols in contrast to print letter symbols. These differences and the characteristics related to them are reflected in the errors associated with reading in the

braille medium.

The data of this error study are analyzed from the standpoint of the medium itself, its perceptibility and interpretability; and from the standpoint of the reader with regard to his perception and interpretation of the medium.

A number of factors bear upon the perceptibility and interpretability of braille symbols. They may be interpreted in terms of the dots they have and in terms of what they do not have. Only one symbol "has everything", the six dot symbol standing for "for" ⠿ . One braille symbol has nothing, the 64th possible combination contains no dots and is used as a space. All others can be described in terms of what they have-not about as well as in terms of what they have. Braille readers may say, for example, that "q" ⠟ has everything but dot six. To illustrate further, what represents "ch" ⠡ , "gh" ⠣ , "sh" ⠩ , "th" ⠹ , were developed from the symbols for "u" ⠥ , "v" ⠧ , "x" ⠭ , and "y" ⠽ by dropping out dot three. In addition to the presence or absence of dots or stimuli to be perceived, the number of stimuli is important. The distribution of number of dots in the 64 combinations is shown in the following table.

Table 9

Number of Symbols Containing Various Numbers of Dots

No Dots	One Dot	Two Dots	Three Dots	Four Dots	Five Dots	Six Dots
1	6	15	20	15	6	1

While 64 combinations exist, only seven can be differentiated in terms of number of dots alone. Dot placement, or shape and configuration must be used to identify the other combinations. It is known that readers often respond to the symbols

with relatively minimal conscious attention to number. Shape therefore becomes an important factor, and a limited number of shapes are possible. Only 19 different single cell types of shape or configuration exist. The shape-types are shown in table 10 with the number of positions (in parenthesis) each takes to make possible the 63 combinations.

Table 10

Shape-types of Braille Dot Combinations

(with number of positions taken following in parenthesis)

One Dot	Two Dots	Three Dots	Four Dots	Five Dots	Six Dots
 (6)	 (7)	 (8)	 (2)	 (4)	 (1)
	 (4)	(4)	 (4)	 (4)	
	 (2)	 (2)	 (4)		
	 (2)	 (4)	 (2)		
		 (2)	 (2)		
			 (1)		
Totals:					
6	15	20	15	6	1

The limited number of shape-types in braille requires that they be used in various positions in order more nearly to provide the number of meanings that the language requires. Since, each braille symbol requires one fourth of an inch of linear space per line and each line requires two fifths of an inch of vertical space, material in braille is bulky and cumbersome. These characteristics of a three dimensional (raised dot) reading medium immediately suggest the desirability

of space saving efforts.

Several kinds of efforts have been made in order to conserve space in reading materials. Braille symbols have been assigned multiple meanings which depend on position within the braille cell and on the context of the reading material for their meaning. Contractions have been developed so that from two to five letters can be represented in from one to two cells. A number of abbreviations for words have been specified as a part of the code. All of these space saving efforts, while accomplishing their purpose to some extent have added to the complexity of the medium, and, therefore, of reading.

Differentiations, therefore, are made among braille symbols in terms of what is and what is not present in them; by the number of dots they contain; by the configuration or shape they take, determined by the relationship among the dots; by the position of the shape within the cell; and by their relationship to the content of the reading material. The multiple meaning, contraction, and abbreviation efforts at space saving also are related to the tasks of perception and interpretation in reading in the medium of braille. The analyses of braille reading difficulties were, therefore, made along these lines.

The low incidence of error, about five errors per 100 words read, is a positive and encouraging finding of the study. Braille is often described as a difficult, cumbersome, and illogical system. Everyone would agree that it is less efficient than print as a reading medium. Nevertheless, this study, which concentrated upon errors and held a widely inclusive definition of error, revealed relatively little difficulty in a large sample of children of wide range in age, grade, and ability. It is important to maintain this perspective, since involvement in the study of errors tends to magnify the difficulties.

The low incidence of identified error makes many of the analyses proposed at the outset of the study seem impractical. Analysis for sex differences and

differences in educational program are examples. Therefore, emphasis in the analyses has been placed largely upon eight types of errors which appear to provide promising leads for improvement in instruction, material for instruction, and possible braille code revision. These analyses will follow a consideration of the difficulties encountered in the orthographic categories.

The general order of difficulty of the orthographic categories is as follows, listed from most to least difficulty:

Rank	Category	Title
1	VI	Short form words
2	V	Multiple cell contractions
3	VII	Combinations of orthography
4	IV	Lower contractions
5	III	Upper contractions
6	I	Full spelling
7	II	Alphabet abbreviations

Short Form Words (Category VI)

The factors which make many category VI words the most difficult in the study are clearly difficulty of meaning and infrequency of appearance. However, there are a number of frequently used words with common meanings that also have large error indices, such words as "also", "always", "above", "either", "tomorrow", "such", "paid", and "him". It appears that the space-saving efforts have so reduced the short form words that the abbreviations cause special difficulties. Relavitely little of the full spelling of the word is retained, minimizing the utility of word attack techniques and putting the burden for recognition of these words on memory. Reference to counts of frequency of appearance (Lockhead 1954 and Irwin, 1929) show that the incidences of many of the more difficult short form words in general literature are so low that little space saving is actually accomplished. However, difficulty is added by them to reading in braille. The data here presented on difficulty from the standpoint of error, considered with data on frequency of appearance can provide useful guidelines for decisions with regard to words that might be more

form. Recommendations in this regard are made later in this chapter.

Multiple Cell Contractions (Category V)

Multiple cell contractions were involved in words which were second in order of difficulty for the readers. Even though much of the difficulty came from several infrequently appearing words such as "character", "lord", and "spirit", many useful and frequently appearing whole words such as "these", "those", "whose", "where", "upon", "ever", and "cannot" seemed to present an inordinate amount of difficulty because of the nature of their configuration as multiple cell braille contractions.

It would seem appropriate to replace "character" with a more useful word such as "change", and to replace "spirit" with a useful word like "same". In connection with the consideration of types of errors later in this chapter, some additional recommendations are made which are related to the problems of multiple cells.

Combinations of Orthography (Category VII)

The third most difficult category of words studied was that of combinations of orthography. Among the most difficult features of these words were lower contractions and multiple cell contractions.

As in the case of short form words, much of the difficulty can be attributed to infrequent appearance and meaning problems for elementary grade children. There were, however, special difficulties associated with the braille forms and these will be discussed in the categories which contributed orthographic features to these "combination" words.

Lower Contractions (Category IV)

Words using lower contractions fell intermediate in difficulty in the study.

They were, however, the most difficult of the groups of single cell contractions. The lower forms having only whole word meanings such as "his", "by", "was", "into", "were", and "to" were less difficult than the lower forms having whole and part word meanings such as "in", "en", and "be". This latter group appeared much more difficult as part words than as whole words as well as being more difficult than those having only whole word meanings. As part words, both "be" and "en" each contributed about twice as much difficulty as "in", and as whole words, "be" and "in" contributed very little difficulty by comparison with "en" standing for "enough".

A group of lower contractions representing double consonants when they appeared within words proved especially difficult. Double "b", "c", "d", and "f" all appeared among the eight most difficult words and double "g" appeared in the 19th word (of 43) in order of difficulty.

The words "connect" and "mind" had high order of difficulty apparently related to the lower signs rather than to frequency or meaning alone. Similarly, "daddy", "pink", and "engine" appeared unusually difficult. An evident problem in connection with lower signs is the number of meanings they carry in different contexts. The data of this study suggest that it would be especially useful for children's reading to drop the use of the double consonant meaning from lower signs. This recommendation has been made prior to this study and has received considerable attention, but objective data on children's reading have not been available for support. Additional recommendations are made regarding lower contractions in connection with up-down alignment errors later in this chapter.

Upper Contractions (Category III)

Table 3 indicated that category III words contributed somewhat more difficulty than words in full spelling or alphabetically abbreviated words. Some

category III contractions were used as whole words only; some, as whole words; and some, as part words only. Five of these are one cell whole words which can be used also as part words. They are of special interest because of their great usefulness. They are "with", "of", "for", "and", and "the". When used as whole words, they occurred in the order named from easy to difficult with relatively low error indices. The words in which they appeared as parts have error indices indicating much greater difficulty. The order, from difficult to easy as part words, was "for", "and", "with", "the", and "of". By contrast, signs standing for "sh", "th", "st", "ch", "ou", and "wh" were generally less difficult as part words than as the whole words for which they stood. "Wh" standing for "which" proved most difficult; "sh" for "shall", "st" for "still", "ch" for "child", "th" for "this", and "ou" for "out", followed in descending order of difficulty.

The category III contractions having only part word meanings tended to have lower error indices than did the contractions in the category having both whole and part word meanings.

Among the words of higher order of difficulty were "which", "shut", "straw", "shall", and "shirt". "Which" was often read "where". Substitution of "where" for "which" seemed to result because "which", written "wh" ⠸, was preceded by a capital sign (dot six) thus: ⠠⠸, while "where" is written ⠰⠸ ("wh" preceded by dot five). "Shut" was often read "shoot". The major problem with "straw" was hesitation, accounted for in part by context problems. "Shall" was often read "should"; "shirt" was read "short" and caused many hesitations.

It seems clear that the contractions which have several types of use, and which therefore carry multiple meanings tended to contribute special difficulties.

Full Spelling (Category I)

Category I words are represented in braille letter for letter because they

have been assigned no abbreviations or contracted forms and because they do not contain letter combinations for which there are contraction signs. Category I words contributed less difficulty than any category except the alphabetic abbreviations.

Errors in connection with the words in the reading passages which orthography required to be in full spelling were analyzed to ascertain if some braille letters caused more difficulty than did others. The frequency of appearance of the first 100 letters in the words ranked most difficult by error indices were compared with the first 100 letters in words similarly ranked most easy. The following table shows the results, indicating the five letters found most frequently in difficult and easy words for each grade. The letters "j" and "q" did not appear.

The data of table 11 indicate that clearest consistency of difficulty among

Table 11

Frequently Appearing Letters in Difficult and Easy Words in Full Spelling

Grades	Five Most Frequently Appearing Letters in Difficult Words	Five Most Frequently Appearing Letters in Easy Words
2nd	c, e, f, i, r	a, b, i, p, y
3rd	f, g, i, r, n	a, b, l, m, o
4th	c, i, r, s, v	a, m, t, w, y
5th	d, g, n, r, s	a, l, m, u, w
6th	g, i, d, o, r	a, e, l, m, y

the grades was evident for "r", "i", and "g". Clearest consistency of ease was

evident for "a", "l", "m", and "y". Burklen (1917) provided some data on this problem. His data were based on German readers, evidently adults, reading letters in isolation. "r", "i", and "g", ranked 30th, 14th, and 3rd respectively (lower ranks, easier) among 39 characters ranked. He ranked "a" as 1st, "l" as 7th, "m" as 4th, and "y" as 39th.

There was a tendency for the letters appearing more frequently in difficult words in this study to be represented by shapes which can be found in a greater number of positions and therefore carrying more meaning than the letters found in easier words. Another factor which tended to differentiate the difficult letters from the easy was position in the words analyzed. The letters more frequently found in difficult words appeared medially more often than did the letters appearing frequently in easier words. Studies of difficulty of print letters tend to produce the same type of finding (Woodworth, 1938).

It should be noted that the words in full spelling and alphabetically abbreviated words (use of letters standing alone to represent words), the two categories that use letters rather than contractions, were less difficult than the other categories of orthography considered. Error indices for these words were lowest among the seven categories studied for the five grades (see tables 3 and 4). The study therefore appears to suggest that braille letters do not contribute seriously to difficulty in oral reading of braille. The facts that the number of meanings assigned and the positions of the letters within the full-spelled words appeared more important as sources of difficulty than intrinsic letter difficulty suggests that difficulty with individual letters is not of primary significance as a contributor to braille reading difficulty when words are represented letter for letter.

Alphabetic Abbreviations (Category II)

Category II words, those represented by alphabetic signs standing alone to represent words, contributed the least difficulty of any of the categories. Aside from the words "knowledge", "quite", "rather", "every", "you'd", and "from", the alphabetic words contributed little difficulty. The discussion of error types which follows throws light on the types of problems encounted in connection with these words. However, it can be noted here that the substitution of a more frequently appearing and useful word like "kind" (which Thorndike and Lorge, 1944 shows to have much greater frequency) for "knowledge" would be helpful to children's reading. In order to improve phonetic consistency in the code, a change from having "t" standing alone to represent "that" might be made. The "t" might better stand for "too", for example.

In the foregoing analyses, some of the characteristics of the medium have been studied in connection with errors arising from them from the standpoint of orthography and intrinsic characteristics which have a bearing on reading difficulty in elementary grade children. Another line of inquiry is through the types of errors that readers made.

Error Types

Eight special types of errors associated with reading in braille emerged from an analysis of the data. Chapter IV presented findings related to these error types. These error types seem best understood in terms of the same essentials of reading which have already been named, perception and interpretation. All of the error types involved both perception and meaning problems. However, for purposes of analysis, it seemed appropriate to consider the types under three headings which help in clarification and understanding of them. The first three types of error to be considered can be subsumed under a general

heading of problems in perception. They are missed dot errors, added dot errors, and ending errors. The second group of three error-types seem to be a special case of problems in perception involving spatial orientation and alignment problems. They are reversal errors, vertical alignment errors (or up-down alignment errors), and horizontal alignment errors (left-right alignment errors). The last two of the eight types seem best understood in terms of interpretation problems, or problems of meaning. These have been called association errors and gross substitution errors.

The criteria for classifying errors into these eight types were as follows. Missed dot errors were so classified when the word substituted for the stimulus word should have resulted only if fewer dots were present than actually existed. Added dot errors were so classified when the word substituted for the stimulus words should have resulted only if additional dots were present. In the case of orientation errors, perception appeared to be accurate, meaning was appropriate to the perception, but the spatial orientation was erroneous. In the case of errors in interpretation of meaning, perception appeared accurate, orientation appeared accurate, but the meaning given was erroneous.

Problems Related to Perception

Missed dot errors. Missed dot errors were those in which the response indicated that essential information available in the braille symbols had failed to be perceived or utilized. The difficulty may be described as one of "premature" closure, that is, meaning had been arrived at from only part of the information that was available.

Table 8 indicated this type of problem appeared at the rate of slightly more than four times per 1,000 words read by second graders, ranging down to less than three times per 1,000 words read by sixth graders. Though the incidence tended

generally to decrease in the later grades, its relative magnitude as an error type tended to remain constant and its rank indicated an increase in its relative importance as an error type.

The missed dot type of error was most prevalent in words in which multiple cell contractions were utilized. It ranked first in this category. Missed dot errors also ranked high (second) as a problem where combinations of orthography were utilized. Missed dots were lesser problems with short form words, upper contractions, and words in full spelling, in which they ranked third, fourth, and fifth respectively. Missed dots were least contributive to difficulty in connection with words using lower cell contractions and alphabetic abbreviations.

Examples of missed dot errors where multiple cell contractions are used are:

"father" read "from"

"whose" read "where" or "which"

"here" read "have"

Examples in connection with words comprised of combinations of orthography are:

"discovered" read "covered"

"worked" read "wed"

"hereafter" read "half" (Haf) or "ha" or "have"

Among abbreviated words, missed dot error examples are:

"between" read "beside"

"letter" read "little"

"should" read "could"

Examination of these missed dot error examples indicates some of the problems involved. In these examples, it will be noted often that the letters

standing alone without an antecedent in the adjacent cell have different and unrelated meanings of their own. The antecedents must be utilized as cues to suspend judgment in the text until contextually appropriate closure cues are obtained. Failure to utilize these cues leads to error. The multiple cell missed dot errors reveal a tendency to give the meaning for the letter standing alone rather than the different meaning indicated by the multiple cell contraction.

The study revealed that ability to suspend judgment until "all the facts are in" is extremely important in braille reading. While this same fact is true of print reading, it is even more true of braille. All the factors that require suspended judgment for reading in print are present in braille and braille adds a number of other factors that require suspended judgment. The elements in which judgment must be suspended in reading braille are smaller, and probably less meaningful while carrying more different meanings than the elements on which judgment must be suspended in reading print. An additional kind of context continuity is operating in braille reading. Since the same symbols have many meanings in braille, judgment must be suspended until it is clear which meaning is contextually appropriate from the standpoint of braille orthography.

The "eye-voice" span, or what Hildreth (1958) has insightfully renamed the anticipation or "A-span", is a measure of the suspended judgment essential to readers in print. The "finger-voice span", the braille-reading counterpart, can also better be called the A-span. The development of an optimum A-span by braille readers would appear to contribute significantly to the prevention, elimination, or amelioration of all of the types of errors identified. This is especially true of missed dot errors, which seem to be related to premature closure, or failure adequately to suspend judgment until sufficient facts are "in hand".

Recommendations

In terms of teaching methodology, it seems the best recommendation that can be made in connection with missed dot errors is to work with teaching materials well suited in difficulty level to the children. One cannot suspend judgment, or maintain an A-span, unless he is reading with comprehension. Teaching must be tied closely therefore to meaningful materials. This point needs special emphasis in connection with reading by blind children because their range of experience is more narrow than that of seeing children. Time must be spent in teaching reading to develop the anticipation span. Several ways of doing this suggest themselves: (1) work with short idea units and lead progressively to larger units; (2) if flash-card-type materials are to be used, they should consist of phrases or short sentences rather than words alone; (3) "good" reading mechanics (the physical mechanics of finger and hand position, etc.) must be encouraged constantly, for searching finger movements or erratic physical orientation to the braille material may permit a loss of "base-line" orientation for reading which can lead to missed dot errors.

A majority of missed dot errors occurred in connection with multiple-cell contractions. This finding has implications for possible revision in the braille code itself. It would be most helpful to assign the multiple-cell contractions to common, frequently appearing words. The example cited above in connection with the multiple cell orthographic category of assigning dot five "ch" to "change" rather than "character" is an example. It might also be wise to obtain more consistency by changing dot five "h" from "here" to "has", since "h" standing along represents "have".

It is worthy of note, that braille materials are very scarce. To supplement the materials which come from a very few publishing houses, many volunteers transcribe materials into braille. Because there are many rules governing the

orthography of braille transcription, there tend to be many errors in the materials so prepared. Printing Houses find it necessary to proof-read their materials as many as four times. Volunteers do not often take these pains. There are, therefore, many "legitimate" braille errors that appear in children's reading. The dropping of a single dot is crucial to meaning for braille. There seems to be no doubt that such transcriber errors tend to contribute to reading errors by encouraging children to build up a tolerance for loose meanings in their readings.

Added dot errors. Added dot errors is a category of braille reading problems in which the response to stimulus materials is erroneous because more information is inferred to be present than actually is there. Since the meaning of braille symbols depends on what is not present as well as what is present, and since as reading progresses the reader tends to deal with wholes, there is a tendency to anticipate wholes and to supply missing parts to form them. A disposure by "set" or expectation to anticipate a "whole" may lead to the addition of dots in order to obtain closure for an expected meaning. The incidence of added dot errors (table 8) suggested that the problem decreased with experience in reading, but its rank varied in the grade groups. Added dot problems ranked fourth for second graders, but sixth for the smaller group of third graders. It ranked third for fourth grade readers, fifth for fifth grade readers, and fourth for the sixth grade readers.

The orthographic category in which multiple cell contractions are utilized elicited the largest proportion of added dot errors. Upper cell contractions ranked second with regard to added dot errors.

Added dot errors are illustrated as they are found in the orthographic categories in which they rank highest. In multiple cell contractions, for example:

"some"  read "these" 

"whose"  read "those" 

"never"  read "none" 

In the upper contraction category, examples are:

"which" read "where" 
or
"this" 

"the"  read "there" 

"then"  read "they 

In the alphabetic contraction category, examples are:

"not" read "you" 

"so"  read "some" 

"very"  read "for"

The addition to a braille cell of one dot, either real or fancied, radically changes braille meaning. The space saving features that have been utilized in braille have reduced to minimums the amount of information presented for the perception of words. The fact that added dot problems occurred most frequently in the orthographic categories where there is much contraction and abbreviation in forms indicates that more cues to meaning might be useful.

Since readers in braille utilize a word or whole method of reading, the tendency toward stimulus generalization, or inferring wholes from significant parts operates to facilitate reading. However, space saving efforts have already reduced many representations to a point beyond which further "cue reduction" may result in error.

Recommendations

The necessity of reading for meaning is again emphasized by the added dot type of error. Reading for meaning requires reading material within the range

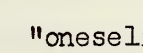
of experience of children. It is, therefore, not enough to determine readability in terms of word forms and sentence length. Readability must be related in terms of meaning as well.

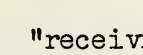
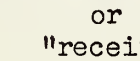
The added dot type of errors shows the important influence of a predisposition or set for what is being read. Methodologically, it should be of paramount importance to teachers of reading in braille to assist children to have appropriate expectations for what they are to read. As McKee (1948) has put it, children need a "taste" of what is being said. This "taste" is especially important for the braille reader because he has the tasks of dealing with the context from the standpoint of meaning and the context of braille in which forms are used differently dependent upon their relation to the meaning context.

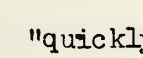
Ending errors. Ending errors are those problems in which an ending has been missed or added, or an erroneous ending has been read for the ending appearing in the text. Like missed dot problems, missed ending errors reflect a failure to get essential information that is available if judgment is suspended and the stimulus is adequately examined in the list of the context before the response is made.

Table 8 indicated how this problem ranked among the grade groups. Ending problems ranked fifth for second graders although the incidence of the problem for this group of readers was similar to that found in the other grades where it ranked higher. Ending problems ranked first for third and fourth graders, and second for fifth and sixth graders. While the problem retained a high rank through the grades, the trend in decreasing magnitude suggested its progressive elimination. This trend is further emphasized when it is recalled that readers in the later grades read considerably more material than their younger counterparts.

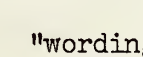
Ending problems were found most often in connection with abbreviated words. This problem was clearly related to the marked reduction in the stimulus and the attending relative ambiguity of the ending of the word for which the abbreviation stands. Examples are:

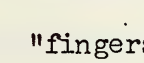
"oneself"  read "one" 

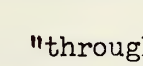
"receiving"  read "receive" 
or
"received" 

"quickly"  read "quick" 

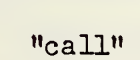
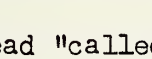
Words involving combinations of orthography cause ending errors, of which examples are:

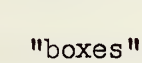
"wording"  read "word" 

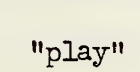
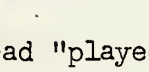
"fingers"  read "finger" 

"throughout"  read "through" 

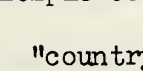
Examples of ending errors contributed by full spelled words are:

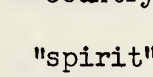
"call"  read "called" 

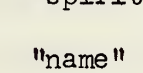
"boxes"  read "box" 

"play"  read "played" 

From multiple cell contractions, examples are:

"country"  read "city" 

"spirit"  read "spirits" 

"name"  read "names" 

In an analysis of 798 specific ending problems, it was found that 29% of the errors involved the omission or addition of an "s". Of the remaining 71%, 21% involved "ing" problems. The "ed" ending was involved in 15% of the ending errors analyzed. Words ending in "self", in some cases abbreviated "f" in braille (as "itself" is written "xf") accounted for 10% of the errors. Problems with "er" accounted for 5% of the 798 errors and the remaining 21% were miscellaneous

addition, omission, or erroneous ending problems.

The practices in braille of using alphabetic initials standing alone for some words and of providing short forms for some words tend to condition readers to short form responses. There is a marked tendency to arrive at premature closure, and endings are missed, guessed at, or erroneously added. As reading rate is increased, there tends to be increased effort at "cue reduction", or a type of stimulus generalization which contributes to problems with endings. To minimize these problems, judgment must be suspended and closure deferred until adequate analysis is made.

Punctuation seems to play a significant role in problems relating to endings. Braille punctuation utilizes letter forms that have punctuation meanings when in the lower part of the cell and when used at the end of a word rather than within the word. For example, "low 'd'" which has the meaning "double d" within the word or "dis" at the beginning of a word has the meaning "period" at the end of the word. Since "d" in the upper part of the cell can stand for "do" when standing alone for its letter meaning in full spelling or at the end of a short form word like "could" ("cd"), its vertical placement must also be considered in judgments regarding its relation to the context, whether it is used initially, medially, or finally, and whether it appears in the upper or lower part of the cell. These problems seem to have a unique relation to ending and punctuation since punctuation is not read in the usual sense, but a word ending treated in the same way produces an ending error.

Recommendations

In teaching reading in braille, special attention should be given to ways to help children avoid the development of ending error problems. Several ways in which this can be done may be suggested. First, it is of primary importance to

encourage an adequate anticipation span so that maximum suspension of judgment can be developed. It appears to be the "jumping to premature conclusions" or closure which causes many ending problems. Secondly, rate of reading should be related to comprehension and efforts to step up rate should proceed only where there is evidence of adequate accuracy in the perception and interpretation of appropriate reading materials. Finally, the difficulty level of reading materials used in instruction should be carefully controlled. Since context plays such an important part in the determination of the meaning which is intended for braille characters, the reader must be able to cope with the meaning if he is to get practice in ascertaining correctly the intended braille meaning.

Some minor changes in the braille code would appreciably contribute to the reduction of ending error problems. In short form words, it would appear to be of help to eliminate the use of final consonants to stand for endings when other ending signs already exist for them. For example, it would seem better to eliminate the short form abbreviation for such words as "receive", since "g" is used to stand for "ing" instead of the "ing" sign (⠬) when "receiving" is written ("rcvg"). It would seem advisable also to reduce the number of meanings attached to the lower forms which are used also as punctuation signs. For example, it would appear to be worthwhile to drop the medial double consonant meaning for the letter signs in the lower part of the cell such as "dd" when they are used also as punctuation signs. This reduction in the number of meanings among which decisions must be made might help to reduce ending problems. Very little space saving would seem to be lost by such changes.

Problems Related to Orientation

Reversal errors. Reversals are those errors related to what may be thought of as "mirror images". They are errors in orientation or the "rotation"

of shapes, or are, in a sense, locational errors. They are reversals similar to those which occur in reading in print when a child reads "saw" for "was", or "b" for "d", "p" for "q", and "u" for "h".

Reversal errors involve the many "mirror images" in braille. For example, "d" ⠙ is a horizontal mirror image of "f" ⠋ . The "f" ⠋ is also a vertical mirror image of "h" ⠓ and a diagonal mirror image of "j" ⠚ . Similarly, "r" ⠗ is a horizontal mirror image of "w" ⠺ ; and "p" ⠏ can be a diagonal mirror image of the symbol for "ble" ⠇ or the number sign ⠼ .

Reversal errors were the most frequent problems of second and third graders. However, this error type revealed the most dramatic trend among the grades. Most notable was the marked improvement that appeared at the fourth and fifth grade levels. However, reversal problems remained evident through the sixth grade.

The orthographic relationship of reversal errors contributes to an understanding of the problem. They ranked highest among alphabet words (first), upper contractions (third), lower contractions (third), and combinations (third). They did not rank higher than fifth among the full spelling, multiple cell, and abbreviated word categories.

Examples of reversal errors are:

In alphabetic contractions

"you" ⠽ read "and" ⠯

"do" ⠙ read "have" ⠱

"have" ⠱ read "was" ⠺
or
"just" ⠚
or
"do" ⠙

In upper contractions

"and"  read "you" 

"shall"  read "must" 

"of"  read "with" 

In lower contractions

"by"  read "to" 

"was"  read "have" 
or
"his"

In combinations

"station" read "children" 

"worked" read "red" 

It has been pointed out that, because braille contains many symmetrically contrasting or mirror image symbols (see table 10), many opportunities for reversals are presented. Most of these opportunities occur in the alphabetic abbreviations. It is in this orthographic category where reversals ranked first, and it is in this orthographic category in which the least number of closely adjacent surrounding orientation cues and context clues are available.

The persistence of reversal errors through the grades raises questions about their source and nature which require answers. While the literature on print reading tends to show the progressive elimination of reversals with experience, it appears that they persist longer in reading braille. One possible explanation for this persistence is poor physical mechanics of reading. The child who uses retracings, and scrubbing finger movements to deciper braille tends to lose his orientation and to increase the possibilities for reversals. Therefore, there would seem to be crucial importance in encouraging good reading mechanics. Good mechanics, however, cannot be preserved when the reading material is too difficult. Just as eye movements must be adapted to the difficulty level of print reading material, so the reading mechanics in braille must be adapted to

the difficulty of materials. The difficulty inherent in reading materials may therefore be the cause of problems in reading mechanics which result in reversal errors. It seems, therefore, an oversimplification to attribute reversal errors solely to poor mechanics. The relationship of mechanics to the reading difficulty of materials must be considered.

Common practice in the preparation of reading materials in braille is to transcribe print materials into braille with relatively little modification. This is true from the very first reading experiences of children throughout the reading instructional program. The question is raised as to the appropriateness of this practice, especially in the beginning reading experience. If there were a one-to-one relationship between the print and the transcribed braille materials, this practice might be more defensible. There are, however, some apparently significant ways in which contexts are changed, especially by the space saving efforts characterizing braille. Abbreviation, contraction, and the assignment of multiple meanings may have effects on the level of difficulty of graded reading materials.

Another possibly significant cause of the occurrence of reversal errors and their persistence, is related to the methods by which braille writing is taught and practiced. In many cases, early braille writing is taught with a slate or guide to position a stylus for embossing the braille dots on paper. This type of writing entails pressing the dots from the under side of the paper and from the right to the left in order that when the material is turned over to be read, the dot relationships will be correct. Writing by this process thus involves the making of mirror images and requires a right to left progression for writing as opposed to the left-right progression utilized for reading. While this problem can be reduced by numbering the dots so that dot one on either side of the paper is the same, the ideation (or "visulaization") of the forms still contributes to

the problems.

Better practice, increasingly widely accepted as braille machine writing equipment becomes more available, is to teach writing from the beginning on a mechanical, upward writing typewriter-type device. This equipment avoids the possible confusion of mirror images and right to left orientation problems. In addition to these advantages, the braille writer method requires less fine muscular-kinesthetic coordination which is difficult for young children. The findings of this study on reversal errors emphasize the value of utilizing the mechanical writing device and avoiding the necessity of slate or guide and stylus writing until reading skills are well established.

Vertical Alignment Errors

Vertical alignment errors are those which are related to up-down orientation within cells or on the line of reading in braille. As noted previously, the same braille shapes have different meanings when vertical differences are employed. These differences are as small as .090 of an inch in position. Confusions resulting from faulty orientation to these small changes in position cause vertical alignment errors.

This error type most clearly showed an orderly trend toward reduction or elimination through the grades, and its magnitude was among the smallest for all the grades. Although no evidence was available for evaluation of the relation of finger size to this problem, it may well be a factor in the orderly reduction of the problem as children mature. It merits noting that the size of braille characters is constant for all reading materials. No larger or smaller type commonly exists for readers at different stages of development comparable to that which is common in reading in print.

Vertical alignment problems were most frequently found in the lower

contraction category, a normal expectation because of the nature of the orthography of this category. A special feature of braille should be noted in this connection: the reference point for vertical alignment in reading in braille. The basic characters in braille are built in the upper part of the cell, and the alphabetic characters, from which all others are merely elaborated, have dots among the top two. Burklen (1917) provided data of interest in this connection, and cited the ratio of upper to lower dots as 129:51 or about 2.5 to one. The baseline for reading, therefore, is the top part of the cell and accounts in part for the problems which occur in connection with lower signs.

Examples of vertical alignment problems are:

Lower contractions:

"was"		read "just"	
"enough"		read "every"	
"were"		read "go"	

Alphabetic abbreviations:

"I"		read "in"	
"just"		read "was"	
"go"		read "were"	

Short form words:

"beyond"		read "by"	
"blind"		read "below"	
"should"		read "shall"	

Recommendations for teaching methods in connection with this type of alignment problems are related to the encouragement of habits of good reading mechanics. The physical orientation of the material to the reader is important because a relatively constant orientation of the fingers to the material is necessary for the accurate perception of the small positional differences which are involved. Reading

Reading exercise materials, especially those in the form of flash cards must utilize phrases or short sentences so that the relationship of lower signs to meaningful materials must be evident. Even though braille orthographic rules require some lower signs to be written without intervening cell space to show their position, exercises in connection with those lower signs must be very carefully planned.

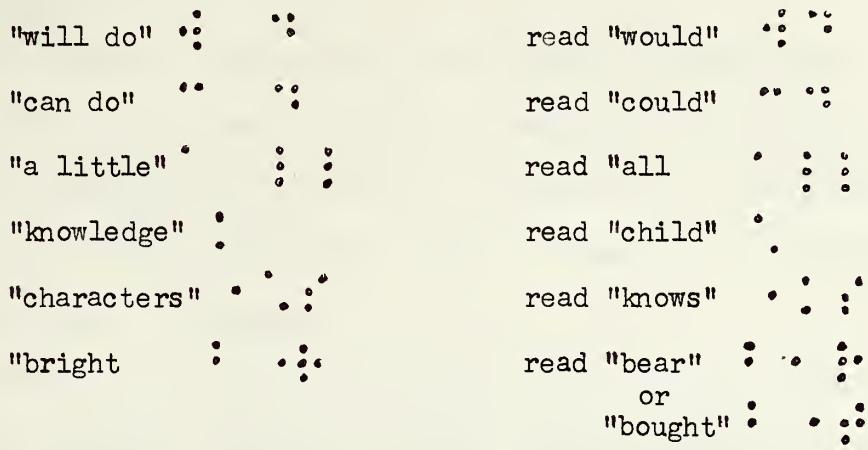
Recommendations already made regarding reducing the number of lower signs utilized and reducing the number of meanings attached to such signs would help to reduce the number of errors of vertical alignment. In addition, the following code changes might be useful. The use of low "j" for "was" and "by", which has no phonetic relationship, should be dropped or changed. One suggestion has been to use the "ed" sign standing alone for these meanings. The low "h" sign standing for "his" might be changed to a short form "hs" in line with the short form for "him"-"hm". The type of change suggested here would appear to reduce the lower sign difficulties considerably.

Horizontal alignment errors. Horizontal alignment errors or left-right alignment errors are those reading mistakes attributable to faulty perception of the horizontal placement of the symbol within or between the braille cells. These errors involve giving a meaning that should be given for the symbol in one side of the cell to the symbol which actually occurs on the other side of the cell. They also arise in erroneously connecting parts of adjacent cells to make "wholes" as if they appeared in a single cell. These errors give evidence that tactually meaningful wholes may sometimes inappropriately utilize parts of two adjacent cells because of the child's faulty orientation to left-right placement.

Left-right alignment problems appeared most frequently in connection with multiple cell contractions. In this orthographic type, left-right alignment

problems ranked third. In words in full spelling, alphabetic words, and words involving combinations of orthography, left-right errors ranked fourth as a problem. These errors ranked sixth or lower in the other categories.

Examples of the error type are:



Left-right alignment problems again emphasize the importance of teaching children to read in braille with meaning. The perception of parts of adjacent characters as a more meaningful whole should not occur when the meaning context of the material is being adequately utilized. Again, an adequate anticipation span should do much to prevent the occurrence of these errors.

In the study of dot, cell, and line spacing cited in the review of the literature (Meyers and others 1955) it was suggested that children would find a closer cell spacing better. The data on left-right alignment problems of this study seem to indicate why closer cell spacing was found better.

It should be noted that so-called open characters, such as "k" , "ch" , and "st" , are often involved in horizontal alignment problems. A word like "know" or "long" leaves much space for the little fingers of young readers to lose their left-right orientation.

The alignment error problems again have implications for the preparation of reading materials in braille, especially with regard to difficulty. The effects of carefully graded reading materials on horizontal alignment errors should be

carefully evaluated before code revisions are considered as a solution to these problems.

Problems Related to Meaning

Association Errors

Association errors are those errors which seem to result from having established an incorrect bond between a braille stimulus and the meaning for which it stands. Because of the nature of the code, especially its abbreviation and contraction features, readers must learn a number of meanings for the symbols and forms as reading skill is developed.

The association type error is one that showed a definite trend toward increased incidence through the grades. Several factors probably account for this. As children grow older and gain more experience, they have a greater repertoire of associations on which to draw. This trend would tend to be more marked in connection with congenitally blind than with adventitiously blinded children, and more marked in both than in seeing children of comparable age.

Association errors ranked higher in alphabetically abbreviated words, in multiple cell contractions and in abbreviated words than they did in connection with other orthographic categories. These errors were thus seen more commonly in connection with that type of orthography in which minimal cues to meaning were available and where, therefore, the freest reign for associations of meanings was possible.

Examples of association errors are:

"do" 

"quite" 

"that" 

read "did"

read "quick"

read "the"

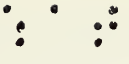
or

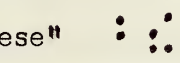
"they"

or

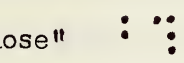
"there"

"where" 

read "what" 

"these" 

read "those" 

"those" 

read "this" 

or

"these" 

"also" 

read "always" 

or

"almost" 

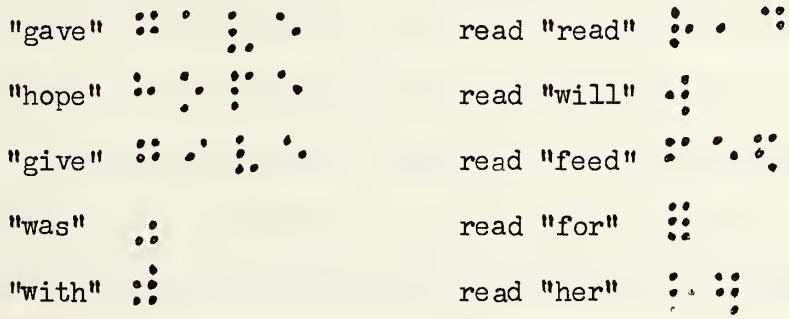
Problems with association errors suggest that the order of introduction of the alphabetic and abbreviated word types of orthography in reading in braille should be based on usefulness so that associations can be well established and frequently reinforced. The planned repetition in reading materials in print may not meet the needs of children reading in braille as well as some specially prepared materials for this purpose. Such an approach bears on teaching methods and materials and can be accomplished without change in the braille code. However, some changes in the code would appear to be useful.

Possible changes in the braille code might be directed toward the provision of more cues in abbreviated words so that less equivocation would exist, for example, "ac", "ag", "al", "ch", "en", which stand for "according", "again", "also", "child", and "enough", respectively. So few of the essential features of these words as wholes are available that, if they are not remembered immediately, little is available other than context to assist in attacking them.

Gross substitutions. Gross substitutions errors are those which are so evidently meaningless as responses to the stimuli which elicited them that they seem to have no logical relationship to braille orthography. The criterion for their classification was that they should not have elements in common with the word as represented in grade two braille for which they were substituted.

The extent of this type of error generally decreased with maturity and experience, but the trend was variable. Marked improvement seemed to take place at the third grade level by comparison with the second. Gross substitutions errors took a position generally intermediate among the other problems for the third through the sixth grade.

Gross substitutions ranked as the most frequent type of error in full spelling orthography. In the other orthographic categories, they did not rank higher than fourth among the error types.



Teaching methods for dealing with gross substitution errors in reading in braille would be the same as those for reading in print. The problem seems to stem from difficulties in meaning. Word attack and word analysis skills need to be build for attacking words for which no signs, abbreviations, or contractions exist.

Readers in braille get much less practice, both intential or guided, and incidental. They are not constantly bombarded with reading materials on every hand as print readers are. The print reading child's curiosity is aroused by signs, both of instruction and advertising; he has many occasions to read things around his home and in his family and play life; television has its influence. The print reading child has a limitless potential of reading materials available to him if some attention is paid to providing them. On the contrary, the braille reading child lacks many of these opportunities. His exposures to reading materials has to be quite deliberate. Even when deliberate, the materials lack the stimulation

and motivating effects of pictures, designs, and colors. Furthermore, even when materials are provided, his slower reading rate allows him to accomplish much less practice per unit of time than the print reading child.

These same factors bear on the range, variety and frequency of experience that are available to blind children, not only the vicarious experience open to him through reading materials, but also direct experiences.

These factors are related to all of the reading errors discussed, but they would seem to relate especially to the kinds of words which tend to elicit gross substitutions. As the data of this study suggest, many such words have no familiar or unique braille signs, abbreviations or contractions in them.

Reading in braille, then, like reading in print, has implications for the total development of blind children. It is not just a matter of providing opportunities for reading, but instruction in reading and growth in experiences must also be provided for optimum growth in reading.

Summary

The findings of the study have been analysed in terms of the premise that the essentials of reading in braille are, like those in print, perception and interpretation. The differences that exist between reading in print and reading in braille lie largely in the differences in modality of perception and in medium to be interpreted. Reading in braille has been examined in terms of its similarities to and differences from print reading.

Oral reading errors in braille have been examined both in terms of orthographic features of the braille code and in terms of error types that predominate in relation to grade levels and orthographic characteristics of braille. Eight error types were subsumed under three headings. Under problems in perception, missed dot errors, added dot errors, and ending error problems were considered.

Under orientation problems, reversal errors, vertical alignment errors, and horizontal alignment errors were considered. Under meaning problems, association errors and gross substitutions were considered.

The data suggest the importance of attention to the difficulty of reading material for instruction in reading in braille. Conventional readability formulae seem to overestimate the readability of materials in braille and more attention needs to be given to meaning than is provided for in conventional means.

The order of difficulty of braille orthographic categories as utilized in this study is relatively constant for the grades studied. However, they present different degrees of difficulty for the different grade groups.

Even when a broad and inclusive definition of reading errors is utilized as it was in this study, the incidence of error, five errors per 100 words read does not appear excessively high.

The space saving efforts used in braille contributed substantially to the reading difficulty encountered. These features are (1) assignment of several meanings to the same braille symbols with context determining meaning; (2) extensive abbreviation of words; (3) the use of contractions to represent from one to five letters with from one to two symbols. Some of the difficulty with respect to these features is attributable to their assignment with little regard to frequency of appearance.

Analysis of letter difficulty indicated they did not contribute seriously to oral reading difficulty in braille. However, letter difficulty seemed somewhat related to the number of meanings assigned to the shape used to represent them and appeared to be in part a function of their placement within words. Those used medially more often tended to be associated with more difficulty.

Alphabetic signs contributed the least difficulty of any of the categories. What difficulty they did produce would be substantially reduced by the substitution

of more common words for "k", "q", and "r", and by a more phonetically appropriate word for "t".

Errors attributable to perception problems were examined. The error types were missed dots, added dots, and ending problems. These problems seemed to result from failure to suspend judgment or to maintain an adequate anticipation span in reading. It is recommended in teaching methodology that attention be given to developing optimum attention span. The difficulty level of reading materials in braille should be controlled, not only from the standpoint of word forms and sentence length, but also with regard to meaning. Some variability in abbreviation practices, such as for word endings contributed special difficulty. These difficulties would be reduced through greater consistency of abbreviation in short form words. Short form words are often abbreviated more extensively than should be necessary or desirable. The space saving value of abbreviation should be weighed against the ambiguity created thereby. The assignment of multiple meaning to the same forms causes difficulties and appreciable improvement should result from a reduction in these meanings.

Errors attributable to problems in orientation were examined. The error types were reversals, horizontal alignment problems, and vertical alignment problems. The numerous mirror images in braille provide many opportunities for reversal errors. Reduction in the number of meanings assigned to the same shapes is recommended. While reading mechanics contributed to these difficulties, the question is raised as to whether they are cause or effect. Poor reading mechanics may result from the difficulty of material and therefore the essential cause of reversals may be the difficulty of material. The level of difficulty of instructional materials for reading in braille should be controlled beyond the control implicit in the print materials that are transcribed. Practices in writing can also contribute to reversal problems. The use of braille writing machines is

recommended. Alignment problems are related to the small differences in position in braille symbols which determine differences in meaning. This is especially true with regard to lower signs, and problems of vertical alignment. The physical mechanics of reading in braille and the reader's physical orientation to the material play significant roles in alignment errors. Instructional practices should include attention to physical orientation of the reader to the materials.

Errors attributable to problems in meaning were examined. The error types were association errors and gross substitutions. Prescribed meanings assigned by the code must be learned for successful reading. The planned repetition in print materials may be less useful for the establishment of meaning associations in braille than might specially prepared materials. Some changes in the braille code would be useful in reducing association errors. These changes would center in providing more cues to meaning in abbreviated words. Gross substitution errors may be minimized by helping braille reading children to have more practice in reading, in acquiring word attack skills, and in increasing the breadth, scope and frequency of real experiences.

Children learn to read in braille and to read quite well in view of many problems. Significant opportunities to improve their reading even more and to reduce the number of errors in reading can be found in teaching practices, in the preparation of appropriate materials, and in possible changes in the braille code.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

In recent years, the number of blind children being educated in day school programs and residential school programs has increased considerably. If these programs are to be effective, much needs to be known about the tools of learning which blind children must acquire. One such tool is reading in braille. The present study was therefore undertaken to throw needed light on problems associated with reading and teaching in the braille medium.

Information has been lacking on the nature of problems in reading in braille which has been based on any sizeable sample of braille reading children. This investigation sought to provide useful information on the type, frequency, and levels of errors that occur in children's orgal reading in braille. The study sought to determine the nature of the types of errors, and their relative prevalence, and the course of their elimination to provide better basis for understanding braille reading behavior. It was anticipated that the investigation would provide promising leads to further research toward more effective use of braille as a medium of reading.

For purposes of gathering data on errors, simple passages of graded reading difficulty were prepared which included virtually all the 185 signs, abbreviations, and contractions of braille in one or more of their common forms. Twelve such passages were prepared and administered as a diagnostic reading test to 728 braille reading children in the second through the sixth grades. The investigation was concentrated upon the second, fourth, and sixth grades. Subjects participating in the investigation were limited to the grade levels indicated, to those who read grade II braille by touch, to those who read at least one full paragraph, and to those who did not have additional handicapping

conditions that would seriously affect their reading behavior.

The procedure followed was to have children read the prepared materials in an individual testing situation in which adequate rapport was obtained and conditions favorable to optimum reading performance prevailed. The errors made by the children were recorded verbatim in a detailed and prescribed manner by the investigator. The test protocol included background, current, and test-setting information related to the study. The 728 test protocols covering the reading of 543,065 words produced 29,112 errors which were transferred to error cards prepared for the 1039 words comprising the 12 paragraphs.

The error data were tabulated according to the type of braille orthography with which they were associated, and by the grade of the children who made them. Errors were classified according to type. More than 90% of the errors classified were found to fall in eight classification groups. The errors in these classifications were studied to determine their relationship to braille orthography, to categories of braille words, and to grade groups. The eight error types were related to perception (missed dots, added dots, and ending problems); orientation (reversals, vertical alignment, and horizontal alignment problems); and memory (association errors, and gross substitutions).

The five grade groups were found to differ with regard to frequency of the eight error types. The implications for prevention, remediation, or amelioration of these types of errors were considered from the standpoint of teaching methodology, instructional materials, and revision of the code.

Recommendations Regarding Teaching Methods

1. Teaching reading in braille should apparently emphasize the development of an optimum attention or anticipation span. Since both the meaning of the reading matter and the meaning assigned to braille configurations is dependent upon

context, judgment must be suspended until contextually appropriate closure can be achieved. Missed dot errors, added dot errors, and ending problems seemed to be related to problems involving premature closure and should be amenable to prevention or amelioration through the development of appropriate anticipation span.

2. Reading instruction should be centered in materials of appropriate reading difficulty level to individual children. Adequate anticipation span for the utilization of context clues evidently cannot be maintained on material of a vocabulary and meaning level which is inappropriate to the reader. Short meaningful idea units may need to be utilized in beginning instruction working toward longer units as children can handle them.

3. Where flash-card drill type materials appear appropriate, they might better be comprised of phrases, short idea units, or short sentences rather than individual words. Individual word drills may lead to errors caused by premature closure for meaning in regular reading materials.

4. Instruction must relate good physical reading mechanics and physical orientation to the reading materials so that perception and orientation problems may be minimized. Searching finger movements and variable orientation of the reading fingers to the material can lead to erroneous reading.

5. Added dot errors suggest that the set or expectations the reader holds for the materials have an important bearing on perception. Additional instructional effort should be devoted to helping children acquire an appropriate mind set for the content of the material to be read.

6. Efforts to increase rate of reading in braille should be related to comprehension. The frequency of ending errors and their persistent high rank through the grades seemed to indicate the necessity of keeping rate at levels where comprehension will not be impeded by ending error problems.

7. The incidence and prevalence of reversal errors suggests that writing

instruction may best await the establishment of basic reading skills, especially if writing instruction must be given on hand-embossed brailling. If braille writing machines are available, it may be more practical to start writing instruction somewhat sooner.

8. Teachers of reading in braille should be aware that the planned repetition in instructional materials for print reading may not contribute optimally to the establishment of memory associations for sign, abbreviation and contraction meanings prescribed by the braille code. In some cases, specially prepared materials may be useful to strengthen the association of appropriate meanings for braille symbols.

9. Gross substitution errors seem to reveal a tendency on the part of some readers to give responses to words that have little relationship to the reality of the word. Such grossly erroneous responses, while evidently indicating a lack of word attack skills also seem to indicate a lack of experience. Since blind children tend to have fewer experiences, both first hand and vicarious (such as reading), additional stimulation and opportunities for experiences may need to be provided.

Recommendations Regarding Materials

1. Instructional materials for reading in braille should be provided at appropriate difficulty levels for the reading development level and experience of the students. Materials in which there are many multiple-cell contractions, short form words, and lower cell contractions seem to cause special difficulties for children reading in braille. Conventional print readability evaluation procedures may overestimate the readability of materials transcribed in braille.

2. Because the addition or dropping of braille dots is crucial to the meaning of a braille symbol, extreme care may need to be taken for accuracy of

materials in braille. Hand transcribed materials to supplement scarce commercially published materials should be examined with care for the correctness of the braille transcription.

3. It might be useful to prepare materials in braille with repetition specially planned for the establishment of meaning in braille. Such exercises might accomplish purposes not effected by the transcription to braille of already published print materials.

Recommendations Regarding Revisions in the Braille Code

1. Other short form words might be more useful than those currently used. When revision of short form words is considered, more cues for word recognition could be provided.

2. Reduction in the number of uses and meanings assigned to contractions would apparently reduce reading errors. This is especially true of lower contractions.

3. Some changes in alphabetic abbreviations would make them more useful for children's reading. Changes should be directed toward more frequently appearing words and should consider consistency in phonetic characteristics.

4. Code revision could provide more grammatical and phonetic logic in abbreviations and contractions that would reduce errors in reading.

5. Code revision should be directed toward decreasing the variability in the endings of words.

6. Further research should be conducted as a guide to appropriate directions for code revisions.

Suggestions for Further Research

The findings and recommendations of this descriptive study lead to many possible suggestions for further research. Experimental studies will be needed

to explore the inferences that may be drawn from the data of this study. These inferences should be seen as the raw material out of which hypotheses can be developed for experimental verification.

1. The effectiveness of different approaches to teaching reading in braille should be explored experimentally. The types of errors identified in the current study suggest criteria in terms of efficiency in prevention of these error types as a basis for developing experimental hypotheses. For example, it might be hypothesized that emphasis on a method of increasing the anticipation span would reduce the frequency of missed or added dot and ending error problems.

2. It may be hypothesized that the use in teaching of materials especially prepared to provide a programmed introduction of the more difficult braille meanings would reduce the frequency of errors in braille reading.

3. Experimental study should be productive of leads to ways in which the earlier reduction of the frequency of reversal errors may be brought about.

4. Factors affecting readability of braille materials should be studied experimentally and means of describing readability in more meaningful terms should be developed.

5. The space saving features of braille should be evaluated through controlled study of their effects on reading and the comprehension of meaning. The point of diminishing returns from contraction and abbreviation should be studied.

6. Study should be made to determine equitable division of the numbers of meanings assigned to the same braille symbols.

7. Ways of developing an accelerated optimum rate of reading with regard to efficient comprehension should be studied. Such study might be developed through scientific evaluation of both the braille code itself and comparison of the effectiveness of different controlled methodological testing approaches.

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APPENDIXES

APPENDIX A

CHRONOLOGICAL AGES OF THE SUBJECTS BY GRADE, SEX, AND EDUCATIONAL FACILITY

Age Intervals		2nd Grade				3rd Grade				4th Grade				5th Grade				6th Grade			
		M		F		M		F		M		F		M		F		M		F	
		R	D	R	D	R	D	R	D	R	D	R	D	R	D	R	D	R	D	R	D
17-7	17-12																	1			
17-1	17-6																	1		3	
16-7	16-12																	3		2	
16-1	16-6																	3		3	
15-7	15-12											1				1		2		2	
15-1	15-6					1				3		1				1		5		5	
14-7	14-12					0				2		0				0		9		2	
14-1	14-6			1		1				2		2				0		5		3	
13-7	13-12			1		0				3	1	2		2		1		10	1	13	
13-1	13-6			1		0				6	1	3		6		1		17	2	11	1
12-1	12-12			1		0		2		5	0	3	1	2		3		11	4	10	1
12-1	12-6	1		0		1		0		6	2	3	0	4		3		11	4	11	3
11-7	11-12	1		0		0		1		9	0	2	2	3		2	1	8	1	13	2
11-1	11-6	1		1		1		0	1	13	3	10	2	4		3	2	4	1	2	4
10-7	10-12	5		6		2		2	0	9	1	8	1	3	1	2	6		3	1	
10-1	10-6	7		9		3	2	3	1	21	4	12	6	1	5	1	2				
9-7	9-12	13	1	7	0	3	1	5	0	16	4	10	5	1		1					
9-1	9-6	15	2	5	1	1	4	2	3	1	2	8	7								
8-7	8-12	19	2	13	4	0	1	0	4	4	2		1								
8-1	8-6	11	6	15	2	1	3	1	2												
7-7	7-12	13	9	10	2		0														
7-1	7-6	5	2	7	4		1														
6-7	6-12			1																	
		91	22	78	13	14	12	16	11	100	20	65	26	26	6	19	11	90	16	81	11
		113		91		26		27		120		91		32		30		106		92	
		204				53				211				62				198			

APPENDIX B

INTELLIGENCE RATINGS BY GRADE, SEX, AND EDUCATIONAL FACILITY

	RESIDENT					DAY					ALL				
	VS	S	AV	B.AV	VD	VS	S	AV	B.AV	VD	VS	S	AV	B.AV	VD
2nd (204)															
Boys	3	25	44	16	3	1	8	10	3	0	4	33	54	19	3
Girls	4	18	39	15	2	1	6	5	1	0	5	24	44	16	2
Both	7	43	83	31	5	2	14	15	4	0	9	57	98	35	5
Percent	4.0	25.4	49.7	18.3	2.9	5.7	40.0	42.8	11.4	0	4.4	27.9	48.0	17.1	2.5
3rd(53)															
Boys	2	2	7	3	0	1	3	5	2	1	3	5	12	5	1
Girls	0	5	10	1	0	2	5	3	1	0	2	10	13	2	0
Both	2	7	17	4	0	3	8	8	3	1	5	15	25	7	1
Percent	6.6	23.3	56.6	13.3	0	13.0	34.8	34.8	13.0	4.3	9.4	28.3	47.1	13.2	1.9
4th(211)															
Boys	4	22	55	16	3	0	9	8	3	0	4	31	63	19	3
Girls	2	17	27	16	3	3	11	9	3	0	5	28	36	19	3
Both	6	39	82	32	6	3	20	17	6	0	9	59	99	38	6
Percent	3.6	23.6	49.6	19.3	3.6	6.5	43.5	37.0	13.0	0	4.3	27.4	41.9	18.0	2.8
5th(62)															
Boys	1	6	14	5	0	1	4	1	0	0	2	10	15	5	0
Girls	0	6	11	1	1	0	4	5	2	0	0	10	16	3	1
Both	1	12	25	6	1	1	8	6	2	0	2	20	31	8	1
Percent	2.2	26.6	55.6	13.3	2.2	5.8	47.1	35.2	11.7	0	3.2	32.2	50.0	12.9	1.6
6th(198)															
Boys	2	23	48	16	1	0	10	5	1	0	2	33	53	17	1
Girls	1	22	32	23	3	1	6	4	0	0	2	28	36	23	3
Both	3	45	80	39	4	1	16	9	1	0	4	61	89	40	4
Percent	1.8	26.3	46.8	22.8	2.3	3.7	59.2	33.3	3.7	0	2.0	30.8	44.9	20.2	2.0

Key: V.S. - Very Superior
S. - Superior
Av. - Average
B. Av. - Below Average
V. D. - Very Dull

APPENDIX C

YEARS OF BRAILLE READING EXPERIENCE BY GRADE, SEX, AND EDUCATIONAL FACILITY

	RESIDENT												DAY								
YR.	1	2	3	4	5	6	7	8	9	10	11	AVG.	1	2	3	4	5	6	7	8	AV.
2nd Grd.																					
B.	4	59	19	7	2							2.4	2	14	4	2					2.3
G.	5	52	15	3	3							2.3	2	8	3	0					2.1
BOTH	9	111	34	10	5							2.4	4	22	7	2					2.2
ALL	13	133	41	12	5							2.3									
3rd Grd.																					
B.			7	5	0	1	1					3.9	0	3	8	1					2.8
G.	1	1	8	6								3.2	0	1	9	1					3.0
BOTH	1	1	15	11	0	1	1					3.5	0	4	17	2					2.9
ALL	1	5	32	13	0	1	1					3.2									
4th Grd.																					
B.	2	2	11	52	23	7	2	1				4.3	1	5	8	3	3				3.1
G.	3	3	6	30	18	4	1					4.1	3	1	6	14	1	1			3.5
BOTH	5	5	17	82	41	11	3	1				4.2	4	6	14	17	4	1			3.3
ALL	9	11	31	99	45	12	3	1				4.0									
5th Grd.																					
B.	1	2	0	4	8	9	2					4.9	0	0	1	0	5				4.7
G.	1	1	1	1	8	5	1	0	0	1		5.1	0	1	1	2	7				4.3
BOTH	2	3	1	5	16	14	3	0	0	1		5.0	0	1	2	2	12				4.5
ALL	2	4	3	7	28	14	3	0	0	1		4.9									
6th Grd.																					
B.	0	2	3	3	8	49	10	11	2	2	0	6.2	0	1	0	2	2	8	2	1	5.6
G.	1	4	2	6	8	35	15	6	3	0	1	5.9	0	2	0	1	1	5	1	1	5.3
BOTH	1	6	5	9	16	84	25	17	5	2	1	6.0	0	3	0	3	3	13	3	2	5.5
ALL	1	9	5	12	19	97	28	19	5	2	1	6.0									

APPENDIX D

MOTIVATION RATINGS BY GRADE, SEX, AND EDUCATIONAL FACILITY

	RESIDENT			DAY			BOTH			
2nd Grade	HIGH	AVG	LOW	HIGH	AVG	LOW	HIGH	AVG	LOW	
Boys	37	35	19	7	10	5	44	45	24	
Girls	36	35	7	9	4	0	45	39	7	
Total	73	70	26	16	14	5	89	84	31	204
3rd Grade										
Boys	4	8	2	2	8	2	6	16	4	
Girls	3	12	1	6	3	2	9	15	3	
Total	7	20	3	8	11	4	15	31	7	53
4th Grade										
Boys	33	52	15	10	7	3	43	59	18	
Girls	26	30	9	19	7	0	45	37	9	
Total	59	82	24	29	14	3	88	96	27	211
5th Grade										
Boys	10	15	1	4	2	0	14	17	1	
Girls	11	8	0	5	6	0	16	14	0	
Total	21	23	1	9	8	0	30	31	1	62
6th Grade										
Boys	42	41	7	11	5	0	53	46	7	
Girls	45	32	4	9	2	0	54	34	4	
Total	87	73	11	20	7	0	107	80	11	198

APPENDIX E

INTEREST RATINGS BY GRADE, SEX, AND EDUCATIONAL FACILITY

	VH	H	AVG	LI	NI	VH	H	AVG	LI	NI	VH	H	AVG	LI	NI	
2nd Grade																
Boys	2	21	51	14	3	0	2	14	6	0	2	23	65	20	3	
Girls	2	17	45	14	0	0	2	6	3	2	2	19	51	17	2	
Total	4	38	96	28	3	0	4	20	9	2	4	42	116	37	5	204
3rd Grade																
Boys	1	8	4	0	1	0	2	8	1	1	1	10	12	1	2	
Girls	0	6	9	1	0	1	2	4	4	0	1	8	13	5	0	
Total	1	14	13	1	1	1	4	12	5	1	2	18	25	6	2	53
4th Grade																
Boys	1	23	58	15	3	1	2	11	5	1	2	25	69	20	4	
Girls	3	14	38	8	2	0	4	18	4	0	3	18	56	12	2	
Total	4	37	96	23	5	1	6	29	9	1	5	43	125	32	6	211
5th Grade																
Boys	0	2	21	3	0	0	1	4	1	0	0	3	25	4	0	
Girls	1	1	15	2	0	1	1	8	1	0	2	2	23	3	0	
Total	1	3	36	5	0	1	2	12	2	0	2	5	48	7	0	62
6th Grade																
Boys	1	20	53	15	1	0	3	9	4	0	1	23	62	19	1	
Girls	3	16	51	11	0	0	2	8	1	0	3	18	59	12	0	
Total	4	36	104	26	1	0	5	17	5	0	4	41	121	31	1	198

Key: V. H. - Very High
H. - High
AVG. - Average
L. I. - Little Interest
N. I. - No Interest

APPENDIX F

TOTAL REPORTED ENROLLMENTS* OF CHILDREN IN THE NATION AND PROPORTION INCLUDED IN STUDY BY GRADES

	ENROLLMENT DAY		ENROLLMENT RESIDENT		TOTAL	
Number in Second Grade	229		497		726	
Number Who Participated in Study	35	15.3%	169	29.4%	204	28.1%
Number in Third Grade	240		507		747	
Number Who Participated in Study	23	9.6%	30	5.9%	53	7.1%
Number in Fourth Grade	183		456		639	
Number Who Participated in Study	46	25.1%	165	36.2%	211	33.0%
Number in Fifth Grade	145		432		577	
Number Who Participated in Study	17	11.7%	45	10.4%	62	10.7%
Number in Sixth Grade	136		435		571	
Number Who Participated in Study	27	19.9%	171	39.3%	198	34.7%

*Data from registration information of the American Printing House for the Blind by personal communication to the investigator.

APPENDIX G

ERROR INDICES

Error Indices for Category I, Full Spelled Words

(Ranks based on indices computed to four places. Indices as recorded rounded off to two places.)

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
Flopsy	.72	1	.55	1	.62	1	.75	1	.75	1	.87	1
skunk	.35	2	.34	2	.38	2	.33	2	.55	2	.30	10
million	.26	3	.07	9	.27	4	.30	4	.48	3	.82	3
honors	.25	4	.15	3	.27	3	.32	3	.33	5	.89	1
track	.20	5	.10	5	.10	8	.22	5	.33	6	.35	7
gifts	.18	6	.04	18	.10	9	.15	8	.25	7	.51	5
drive	.18	7	.07	10	.05	28.5	.12	9	.23	10	.43	6
hide	.17	8	.1-	6	.08	13	.11	12	.24	9	.33	8
surface	.16	9	.02	36.5	.04	41.5	.15	7	.45	4	.77	4
police	.13	10	.06	13	.13	6	.17	6	.24	8	.26	12
games	.12	11	.06	11	.05	28.5	.10	13	.12	18	.29	11
zoo	.11	12	.09	7	.07	17	.12	10	.19	11	.15	23
feet	.10	13	.01	60	.06	22	.06	26	.11	20	.22	15
sun	.09	14	.12	4	.11	7	.07	18	.07	38	.05	49
rang	.09	15	.06	14.5	.07	18.5	.11	11	.13	17	.13	24
hope	.09	16	.02	58	.07	20.5	.05	35	.17	12	.24	14
nose	.09	17	.02	44	.15	5	.04	41	.16	13	.15	22
gave	.08	18	.04	17	.01	82	.08	15	.06	45	.16	21
nice	.08	19	.01	94.5	.03	49	.06	24	.14	15	.18	17
felt	.08	20	.02	39	.00		.05	33	.05	47	.32	9
Betty	.07	21	.06	12	.03	49	.07	20	.08	31	.13	26
call	.07	22	.04	25	.03	52	.08	14	.09	30	.12	28
meet	.07	23	.03	29.5	.08	11	.05	31.5	.11	21	.17	19
fire	.07	24	.02	56	.00		.07	19	.11	22	.17	20
nor	.07	25	.03	27	.07	16	.06	27	.10	25	.26	13
live	.06	26	.04	24	.07	20.5	.05	34	.06	43	.13	25
write	.06	27	.02	55	.03	44.5	.05	36	.10	28	.08	18
doors	.06	28	.09	8	.04	38	.05	38	.05	51	.00	
dress	.06	29	.01	66.5	.07	18.5	.06	29	.11	23	.11	31
play	.06	30	.02	33	.04	37	.05	30	.07	35	.09	33
bell	.05	31	.01	66.5	.08	11	.08	16	.04	54	.07	39
boxes	.05	32	.02	41	.03	46	.05	37	.13	16	.09	34
Bob	.05	33	.05	16	.02	62.5	.07	21	.03	59	.05	50
make	.05	34	.03	32	.02	75	.02	70	.04	58	.12	27
ran	.05	35.5	.03	29.5	.05	26	.06	25	.02	68	.06	47
did	.05	35.5	.05	14.5	.08	11	.05	31.5	.02	69	.01	81
ride	.04	38	.02	47	.04	33	.06	28	.12	19	.04	54
tree	.04	38	.02	43	.05	28.5	.04	43	.06	46	.07	41
wants	.04	38	.02	41	.03	46	.08	17	.06	41	.02	70
cake	.04	40	.02	40	.05	28.5	.03	53	.07	36	.08	37
got	.04	41	.04	19	.04	34	.04	40	.07	37	.03	61
dots	.04	42	.02	49.5	.04	35	.06	23	.00		.20	16
truck	.04	43	.06	57	.02	72.5	.03	60	.11	24	.10	32
say	.04	44	.03	20	.05	31.5	.03	52	.00		.11	29

Error Indices for Category I (continued)

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
didn't	.04	45	.04	22	.02	68.5	.04	42	.08	33	.02	68
doesn't	.04	46	.03	26	.08	15	.04	45	.00		.00	
two	.04	47	.03	31	.03	49	.04	48	.02	72	.06	45
tall	.04	48.5	.02	36.5	.02	67	.04	44.5	.06	40	.07	40
Tom	.04	48.5	.03	21	.04	40	.05	39	.03	63	.02	73
am	.03	50.5	.04	23	.03	44.5	.03	58	.04	57	.04	52
woke	.03	50.5	.02	46	.02	56	.06	22	.05	52	.11	30
grades	.03	52	.01	62.5	.08	14	.03	54	.10	29	.07	43
eat	.03	53	.01	94.5	.03	51	.02	62.5	.04	56	.08	38
trees	.03	54	.02	36.5	.04	43	.04	44.5	.06	39	.02	74
tell	.03	55	.01	72	.03	55	.03	55	.08	34	.06	44
me	.03	56	.02	48	.02	57	.02	66	.04	53	.06	46
cans	.03	57	.02	36.5	.04	41.5	.04	51	.03	60	.03	64
took	.03	58	.02	41	.03	46	.03	61	.06	42	.03	57
come	.03	59	.01	73	.01	78	.02	62.5	.02	75	.07	42
gold	.03	60	.01	84.5	.05	24	.03	59	.01	26	.03	65
told	.03	61	.03	28	.02	68.5	.03	50	.03	64	.01	79
has	.03	62	.01	68	.00		.03	49	.06	44	.03	56
glad	.02	63	.01	65	.00		.02	69	.05	14	.02	69
animals	.02	64	.01	84.5	.05	25	.04	40	.05	48	.00	
afraid	.02	65	.02	51.5	.04	39	.03	57	.00		.00	
hill	.02	66	.02	53.5	.02	62.5	.02	64	.10	27	.00	
I'm	.02	67	.01	80	.02	59	.03	56	.00		.09	35
fun	.02	68	.01	69	.02	74	.02	67	.08	32	.01	78
we	.02	69	.02	49.5	.02	60	.02	72	.02	74	.03	58
room	.02	70	.00		.02	65	.02	73	.01	77	.08	36
if	.02	71	.02	53.5	.02	62.5	.02	65	.00		.03	66
saw	.02	72	.02	45	.03	54	.02	71	.00		.00	
easy	.02-	73	.01	77.5	.06	23	.01	84.5	.05	50	.00	
or	.02	74	.02	34	.00		.01	77	.04	55	.00	
box	.02	75	.01	91.5	.00		.01	98	.02	70	.06	48
let	.01	76	.01	64	.02	59	.02	74	.02	76	.00	
Billy	.01	77	.01	61	.01	83	.01	86.5	.02	73	.01	77
my	.01	78	.00	96.5	.02	70.5	.01	94	.00		.03	59
man	.01	79	.01	91.5	.02	70.5	.01	96	.02	66	.03	60
an	.01	80	.01	77.5	.04	36	.01	86.5	.00		.03	62
Billy's	.01	81	.01	88.5	.00		.01	95	.03	65	.04	55
made	.01	82	.01	80	.03	53	.01	90	.00		.04	53
Jane	.01	83	.01	84.5	.00		.01	75	.05	49	.01	83
take	.01	84.5	.02	51.5	.00		.01	88.5	.00		.00	
sure	.01	84.5	.00		.02	59	.01	88.5	.00		.05	51
oh	.01	86	.01	71	.02	66	.00	103	.03	62	.01	80
on	.01	87	.00	98	.01	81	.01	78	.01	79	.02	76
he	.01	88	.01	80	.01	77	.01	76	.01	82	.01	82
look	.01	89	.01	84.5	.00		.01	91	.03	61	.02	67
Joe	.01	90	.01	74	.00		.02	68	.00		.00	
get	.01	91	.00		.00		.01	79.5	.02	71	.02	71
too	.01	92	.01	62.5	.00		.01	84.5	.00		.00	
any	.01	93	.01	70	.00		.01	81	.00		.00	
came	.01	94	.01	91.5	.02	72.5	.01	79.5	.00		.00	
yes	.01	96	.01	84.5	.00		.01	92.5	.00		.02	75

Error Indices for Category I (continued)

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
all	.01	96	.01	88.5	.02	62.5	.00		.01	78	.01	87
funny	.01	96	.00		.05	31.5	.00		.00		.00	
be	.01	98	.00		.00		.00		.01	84	.03	63
is	.01	99	.00		.01	76	.01	99	.01	80	.01	86
I'll	.01	100	.01	75.5	.00		.00		.02	67	.00	
big	.00		.00		.01	80	.01	82	.00		.00	
old	.00		.00		.01	84.5	.00		.00		.01	84
want	.00		.01	91.5	.00		.01	83	.00		.00	
way	.00		.01	84.5	.00		.01	92.5	.00		.00	
happy	.00		.00		.01	84.5	.00		.01	81	.01	85
up	.00		.01	75.5	.01	79	.00		.00		.00	
his	.00		.00		.00		.00		.00		.02	72
at	.00		.00		.00		.00		.01	83	.00	
see	.00		.00		.00		.01	97	.00		.00	

Error Indices for Category II, Alphabetically Abbreviated Words

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
knowledge	.45	1	.32	1	.52	1	.56	1	.57	1	.60	1
quite	.24	2	.12	2	.22	2	.25	2	.44	2	.54	2
rather	.15	3	.07	3.5	.09	7	.16	3	.38	3	.36	4
every	.13	4	.07	3.5	.14	5	.15	4	.17	4	.22	5
you'd	.12	5	.05	7	.16	3	.11	5	.14	5	.38	3
from	.11	6	.07	5	.15	4	.08	7	.12	8	.18	7
us	.07	7	.04	10	.05	9	.06	8	.10	9	.14	8
just	.07	8	.05	8	.04	11	.04	11	.12	7	.21	6
like	.07	9	.07	6	.10	6	.07	6	.02	19	.08	12
so	.06	10	.04	9	.05	8	.05	9	.08	10	.09	10
people	.05	11	.01	16	.04	10	.05	10	.13	6	.13	9
do	.03	12	.01	21	.02	16	.03	15	.04	15	.09	11
very	.03	13	.02	13	.00	26	.02	17	.04	14	.07	13
you	.03	14	.02	14	.03	14	.03	14	.04	12	.05	16
not	.03	15	.01	18	.03	15	.03	13	.04	16	.05	14
move	.03	16	.00	26	.02	18.5	.03	12	.06	11	.05	15
have	.02	17.5	.01	22.5	.03	13	.02	19	.03	17	.05	17
that	.02	17.5	.02	12	.02	17	.02	18	.02	20	.05	18
but	.02	19	.01	19	.02	18.5	.03	16	.04	13	.03	19
can	.02	20	.02	11	.03	12	.02	20	.01	23	.03	21
go	.02	21	.01	17	.01	23	.02	21	.02	22	.03	20
as	.01	22	.01	20	.01	25	.01	24	.03	18	.02	22
will	.01	23	.01	15	.01	21	.01	23	.01	26	.01	26
I	.01	24	.01	22.5	.01	22	.01	22	.01	25	.01	23
it	.01	25	.01	24	.02	20	.01	26	.02	21	.01	24
a	.01	26	.01	25	.01	24	.01	25	.01	24	.01	25

Error Indices for Category III, Words Containing One or More Upper Contractions

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
which	.39	1	.28	1	.17	10	.47	2	.51	3	.50	5
straw	.34	2	.12	5	.18	8	.23	7	.45	4	.73	2
system	.30	3	.08	13	.31	3	.51	1	.67	2	.67	3
forget	.30	4	.27	2	.40	1	.31	5	.35	7	.22	26
shirt	.29	5	.07	15	.14	12	.31	4	.45	5	.65	4
approved	.29	6	.17	3	.39	2	.32	3	.73	1	.78	1
flowers	.21	7	.10	10	.17	11	.18	10	.31	8	.39	8
shall	.21	8	.11	7	.22	4	.17	12	.24	13	.38	9
still	.20	9	.10	8	.08	18	.25	6	.21	17	.32	14
child	.17	10	.05	20	.08	17	.13	16	.24	14	.48	6
lying	.17	11	.08	14	.20	7	.19	9	.38	6	.31	16
shut	.17	12	.15	4	.21	5	.17	11	.09	41	.26	21
eight	.15	13	.06	16	.05	32	.17	13	.15	24	.35	10
touch	.15	14	.15	12	.17	9	.21	8	.14	28	.20	27
sister	.14	15	.05	21	.05	34.5	.13	17	.22	16	.30	17
washing	.13	16	.12	6	.11	15	.14	14	.23	15	.13	40
candy	.13	17	.05	23	.05	38	.10	21	.15	26	.27	20
getting	.13	18	.06	18	.12	14	.11	19	.20	18	.22	25
toward	.12	19	.01	81	.03	52.5	.09	25	.28	10.5	.35	11
stairs	.11	20	.04	26.5	.02	71	.14	15	.15	24	.28	18
whole	.11	21.5	.01	78.5	00		.10	22.5	.15	24	.40	7
without	.11	21.5	.02	61.5	.07	20	.10	22.5	.31	9	.20	29
laugh	.11	23	.03	44	.07	26	.12	18	.18	20.5	.20	28
trouble	.11	24	.10	11	.20	6	.05	37	.13	33	.33	12.5
bed	.11	25	.04	30	.05	34.5	.05	38	.04	66	.32	15
four	.11	26	.04	29	.07	26	.05	36	.18	20.5	.27	67
this	.10	27	.10	9	.08	19	.11	20	.14	30	.10	48
table	.10	28	.02	53.5	.03	55.5	.09	26	.06	60.5	.26	22
Jerry's	.09	29	.06	17	.07	24	.07	27	.28	10.5	.12	41
morning	.09	30	.03	36	.00		.07	30	.15	26	.18	32
our	.08	31	.05	22	.05	34.5	.06	32	.06	60.5-	.18	31
each	.08	32	.02	53.5	.03	55.5	.05	43	.16	22	.19	30
cloud	.08	33	.05	19	.13	13	.07	29	.14	31	.13	38.5
older	.08	34	.02	51.5	.07	26	.06	35	.27	12	.14	37
taught	.08	35	.03	31	.06	28	.10	24	.14	28	.33	12.5
barn	.08	36	.04	24	.02	78	.05	39.5	.11	37.5	.15	34
Jerry	.06	37	.01	67.5	.02	62	.02	84	.02	83	.01	86
lived	.06	38	.04	28	.05	34.5	.05	42	.08	42	.11	46
white	.06	39	.02	55	.02	78	.05	39.5	.11	37.5	.11	47
stood	.06	40	.02	50	.02	71	.05	41	.13	35	.15	35
best	.05	41	.03	33	.09	16	.06	31	.13	34	.00	
covered	.05	42	.02	59.5	.07	21	.06	33	.07	46.5	.13	38.5
others	.05	43	.02	57	.05	30	.05	44	.07	45	.11	42
now	.05	44	.02	64	.03	52.5	.07	28	.13	36	.05	65
going	.05	45	.01	69.5	.01	83	.03	64	.02	76	.14	36
house	.04	46	.01	91	.01	85	.04	48	.07	52	.09	51
her	.04	47	.03	45	.05	49	.03	61	.06	56	.07	55.5
off	.04	48	.03	38	.04	46	.05	47	.14	32	.04	67
better	.04	49	.03	32	.05	29	.03	54.5	.07	51	.05	60
hard	.04	50	.01	85	.01	82	.02	68	.07	44	.15	33

Error Indices for Category III (continued)

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
stop	.04	51	.04	26.5	.00		.03	51.5	.03	73.5	.07	55.5
with	.04	52	.02	51.5	.03	58	.03	59.5	.06	62	.06	58
who	.04	53	.02	53	.04	44	.05	44	.03	68	.04	72
then	.04	54	.03	34	.05	32	.04	49	.00		.04	72
walked	.04	55	.03	43	.02	76.5	.05	43	.06	55	.03	74
study	.03	56	.01	71.5	.07	22.5	.03	57.5	.07	49	.22	23.5
other	.03	57	.01	78.5	.01	81	.03	54.5	.02	75	.10	50
how	.03	58	.03	41.5	.04	50	.02	75	.02	81	.08	53
stay	.03	59	.03	47	.03	57	.03	53	.04	62	.05	63
card	.03	60	.01	82	.01	84	.02	78	.01	85	.10	49
wanted	.03	61	.02	61.5	.02	71	.06	34	.08	43	.00	
asked	.03	63	.01	69.5	.03	51	.03	67	.06	59	.06	57
king	.03	63	.03	46	.07	22.5	.02	72	.00		.11	44
living	.03	63	.04	25	.05	41.5	.02	72	.00		.00	
car	.03	65	.02	63	.02	76.5	.03	56	.07	53	.04	69
what	.03	66.5	.01	83	.02	65	.02	70	.04	65	.07	54
feed	.03	66.5	.02	49	.00		.04	50	.05	40	.02	81.5
early	.03	68	.03	37	.04	45	.03	59.5	.00		.00	
they	.03	69	.01	66	.05	39	.03	62	.03	72	.04	68
cars	.03	70	.03	35	.00		.03	51.5	.00		.04	72
out	.03	71	.11	65	.00		.02	74	.02	80	.09	52
united	.03	72.5	.00		.05	41.5	.01	90.5	.20	19	.22	23.5
another	.03	72.5	.02	56	.05	41.5	.01	90.5	.07	49-	.11	44
dollars	.02	74.5	.03	39	.02	67	.01	94	.07	46.5	.05	61.5
looked	.02	74.5	.03	40	.04	47.5	.03	65.5	.00		.00	
dressed	.02	75	.01	78.5	.02	71	.02	81.5	.05	63	.06	59
of	.02	77	.02	58	.02	64	.02	69	.02	82	.04	66
down	.02	78	.03	41.5	.05	32	.01	88	.03	73.5	.01	84.5
summer	.02	79	.00		.02	76.5	.02	80	.06	57.5	.05	64
for	.02	80	.00		.02	61	.02	79	.02	78	.02	80
farm	.02	81	.00		.03	54	.03	63	.06	57.5	.02	83
called	.02	82	.01	78.5	.02	71	.02	81.5	.10	39	.01	84.5
then	.02	83	.01	67.5	.02	60	.02	72	.02	77	.03	75
watch	.02	84.5	.01	88	.02	67	.03	65.5	.00	"	.05	61.5
water	.02	84.5	.01	75.5	.04	47.5	.02	76.5	.00		.03	77.5
own	.02	86	.02	59.5	.00		.01	87	.06	54	.02	81.5
she	.02	87	.01	86	.02	76.5	.01	86	.03	70	.03	76
show	.02	88	.00		.02	59	.03	57.5	.07	49-	.00	
and	.01	89	.01	73	.01	80	.02	83	.01	84	.01	89
anything	.01	90	.01	89	.00		.02	76.5	.03	69	.03	77.5
than	.01	91	.01	87	.05	41.5	.01	90.5	.00		.00	
are	.01	92	.01	84	.00		.00		.03	71	.02	79
over	.01	93	.01	75.5	.02	67	.01	85	.00		.00	
kings	.01	94	.01	71.5	.00		.00		.04	64	.04	70
saying	.01	95	.01	74	.02	63	.00		.00		.00	
the	.01	96	.01	90	.01	86	.01	93	.01	86	.01	88
states	.01	97	.00		.00		.01	90.5	.00		.11	44
red	.01	98	.00		.00		.01	95	.02	79	.01	87
school	.00		.00		.00		.00		.00		.00	

Error Indices for Category IV, Words Containing One or More Lower Contractions

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
enough	.41	1	.23	3	.32	1	.51	1	.64	2	.41	6
connect	.38	2	.23	2	.13	8	.43	2	.51	4	.56	3
giraffe	.28	3	.27	1	.26	2	.19	5	.35	5	.53	4
accident	.24	4	.07	15	.25	3	.31	3	.55	3	.83	1
difficult	.21	5	.08	14	.19	4	.27	4	.67	1	.60	2
engineer	.17	6	.04	12	.10	9	.18	9	.31	6	.38	8
daddy	.16	7	.04	13	.08	11.5	.10	11	.13	16.5	.38	7
rabbit	.16	8	.08	5	.13	7	.12	8	.17	13	.29	12
pink	.15	9	.06	7	.08	11.5	.08	18	.13	16.5	.36	9
engine	.13	10	.05	8	.14	6	.11	9	.21	8	.13	22
mind	.12	11	.02	28	.00		.06	20	.19	10.5	.44	5
peanuts	.12	12	.05	9	.09	10	.12	7	.26	7	.31	11
president	.12	13	.10	4	.16	5	.10	12	.20	9	.33	10
his	.11	14	.07	6	.08	13	.09	13	.18	12	.22	15
learn	.07	15	.02	25	.04	19	.06	22	.06	26	.27	13
inside	.09	16	.05	11	.03	26	.09	14	.19	10.5	.17	17
by	.09	17	.05	10	.07	14	.09	15	.13	18	.17	16
began	.07	18	.03	19	.03	27.5	.09	16	.17	14	.11	24
eggs	.07	19	.04	18	.07	15	.08	17	.12	19	.09	26
hear	.06	20	.02	30	.03	27.5	.07	19	.10	20	.11	23
enjoy	.06	21	.01	37	.04	22.5	.06	21	.16	15	.24	14
gotten	.06	22	.03	21	.06	17	.11	10	.00		.13	20
find	.06	23	.00		.05	18	.05	24	.06	27	.14	19
tin	.05	24	.05	16	.02	32	.05	25.5	.07	24	.13	21
was	.05	25	.03	20	.04	20	.05	23	.07	23	.08	29
years	.05	26	.01	40	.00		.03	28	.00		.16	18
into	.04	27	.02	27	.04	24	.04	27	.05	28	.08	28
dream	.04	28	.05	17	.02	30	.02	34	.07	25	.00	
come	.03	29	.03	23	.02	31	.05	25.5	.03	32	.03	33
were	.03-	30	.01	31	.02	29	.02	33	.04	31	.08	27
head	.03	31	.03	22	.04	22.5	.03	31	.10	21	.00	
went	.02	32	.02	26	.03	25	.03	30	.04	29	.01	39
comes	.02	33	.01	32	.06	16	.02	32	.00		.07	30
becomes	.02	34	.02	24	.04	21	.02	37	.00		.00	
finds	.02	35	.02	29	.00		.03	29	.08	22	.04	31
ready	.02	36	.01	41	.01	34	.02	35	.01	36	.03	32
train	.01	37	.01	34	.00		.02	36	.02	34	.01	35
happen	.01	38	.01	33	.00		.01	41	.00		.09	25
in	.01	39	.00		.01	35	.01	38	.02	33	.02	34
to	.01	40	.01	36	.01	33	.01	40	.01	35	.02	36
read	.01	41	.01	39	.00		.00		.04	30	.01	37
heard	.01	42	.01	35	.00		.01	39	.00		.00	
be	.00		.01	38	.00		.00		.00		.01	38

Error Indices for Category V, Words Containing Multiple-Cell Contractions

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
character	.84	1	.75	1	.80	1	.94	1	.86	1	.93	1
whose	.75	2	.69	2	.77	2	.79	2	.66	3	.87	3
spirit	.55	3	.43	4	.50	4	.67	3	.76	2	.87	4
lord	.51	4	.46	3	.60	3	.50	4	.62	4	.60	8
upon	.41	5	.25	6	.28	5	.45	6	.53	6	.60	7
question	.37	6	.16	12	.14	18	.41	7	.60	5	.72	6
those	.36	7	.25	5	.21	10	.44	5	.46	7	.51	12
unless	.33	8	.18	8	.18	13.5	.35	9	.45	8	.90	2
dance	.26	9	.16	13	.17	15	.29	10	.38	10	.41	14
ought	.25	10	.16	11	.16	17	.26	11	.41	9	.59	9
these	.24	11	.17	10	.25	6	.21	14	.32	13	.36	16
mansion	.23	12	.11	17	.25	7	.39	8	.33	12	.44	13
cannot	.22	13	.13	15	.19	11	.23	12	.36	11	.37	15
usually	.22	14	.18	9	.09	22	.20	15	.32	14.5	.78	5
ever	.21	15	.18	7	.22	9	.20	16	.26	20	.24	19
where	.20	16	.15	14	.18	12	.20	17	.26	18	.25	18
bright	.18	17	.13	16	.23	8	.22	13	.24	22	.10	34
words	.17	18	.09	20	.17	16	.15	19	.28	16	.33	17
moment	.14	19	.04	29.5	.18	13.5	.15	18	.10	32.5	.54	10
holiday	.14	20	.09	18.5	.04	30.5	.14	20	.32	14.5	.52	11
anywhere	.12	21	.04	32.5	.10	21	.13	21	.25	21	.20	21
here	.12	22	.03	34	.05	28	.10	28	.17	27	.24	20
under	.12	23	.09	21	.02	44	.12	23	.12	30	.20	22
name	.11	24	.06	25	.03	34	.12	22	.18	26	.19	23
through	.10	25	.05	27	.00		.10	26	.23	23	.17	25
everyone	.10	26	.09	18.5	.11	19	.07	32	.27	17	.09	37
city	.09	27	.04	32.5	.05	27	.11	29.5	.23	24	.13	29
bought	.09	28	.06	23	.11	20	.06	34	.26	19	.16	26
their	.09	29	.06	24	.05	26	.09	29	.09	34	.16	27
country	.07	30	.03	35	.07	23	.10	27	.08	36	.10	35
never	.07	31	.01	53	.02	44	.11	24.5	.13	28.5	.12	30
ones	.07	32	.02	37	.04	29	.05	37	.10	31	.18	24
word	.07	33	.08	22	.04	30.5	.08	30	.00		.04	44.5
some	.06	34	.05	26	.05	25	.04	40	.06	40	.11	33
right	.06	35	.05	28	.02	44	.07	31	.13	28.5	.04	46
fence	.06	36	.04	29.5	.04	33	.05	36	.19	25	.05	40
there	.05	37	.03	36	.06	24	.06	33	.09	35	.07	39
many	.04	38	.02	43	.01	47.5	.05	35	.04	45	.09	38
young	.04	39	.02	44	.01	45	.04	39	.07	39	.16	28
father	.04	40	.02	40	.02	39	.05	38	.05	42	.05	41
world	.04	41	.01	52	.02	42	.04	43	.08	37	.11	32
gone	.04	42	.02	39	.04	32	.03	44	.10	32.5	.05	42
pay	.03	43	.04	31	.03	37	.01	52	.01	50	.10	36
party	.03	44	.02	42	.01	50	.04	42	.05	41	.05	43
had	.02	45	.02	38	.03	35	.01	51	.03	47	.04	47
done	.02	46	.02	41	.02	40	.02	47	.00		.11	31
know	.02	47	.01	47	.01	47.5	.03	45	.03	46	.03	49
long	.02	48	.01	46	.03	38	.03	46	.07	38	.00	
one's	.02	49	.01	50.5	.02	41	.04	41	.05	43	.00	
found	.02	50	.02	45	.00		.02	50	.05	44	.04	44.5

Error Indices for Category V (continued)

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
mother	.02	51	.01	49	.01	49	.02	49	.01	49	.03	48
one	.01	52	.01	48	.00		.02	48	.00		.01	50
time	.01	53	.01	50.5	.03	36	.01	53	.02	48	.01	51

Error Indices for Category VI, Short Form Words

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
imm	.72	1	.56	2	.83	1	.83	1	.86	1	1.00	1
concv	.63	2	.51	4	.73	2	.70	2	.76	5	.80	6
rjc	.60	3	.57	1	.60	3	.59	7	.76	5	.87	4
percv	.56	4	.53	3	.44	11	.62	6	.57	10.5	.87	4
acc	.54	5	.39	7	.54	7	.67	3	.81	2	.87	4
alt	.49	6	.33	13	.40	12	.65	4	.76	5	.93	2
rcvg	.49	7	.34	12	.57	5	.65	5	.67	8	.67	12.5
percvg	.47	8	.39	5.5	.55	6	.52	9	.53	13	.67	12.5
dcvc	.45	9	.36	11	.50	8	.52	10	.57	10.5	.60	17.5
concvg	.45	10	.36	10	.59	4	.49	12	.47	19.5	.67	12.5
rjcg	.42	11	.38	8	.32	17	.54	8	.47	19.5	.56	21.5
bey	.42	12	.25	18	.34	16	.50	11	.79	3	.79	7
onef	.42	13	.39	5.5	.45	10	.44	16	.40	23	.56	21.5
bl	.41	14	.29	16	.38	14	.48	13	.62	9	.59	19
rcvc	.38	15	.31	15	.47	9	.45	14.5	.45	21	.26	37
dclg	.38	16	.33	14	.34	15	.42	17	.53	13	.67	12.5
dcl	.37	17	.27	17	.38	13	.45	14.5	.50	16	.48	24
afw	.33	18	37	9	.30	18	.32	19	.50	16	.70	9
nei	.25	19	.13	24.5	.27	19	.23	23	.41	22	.69	10
nec	.24	20	.04	41	.17	23	.41	18	.71	7	.73	8
als	.23	21	.16	20	.14	24.5	.25	22	.29	28	.51	23
ben	.22	22	.13	24.5	.23	20	.26	21	.52	15	.60	17.5
tom	.21	23	.15	21	.12	29	.20	25	.33	26	.29	34
yrvs	.20	24	.24	19	.14	26	.14	30	.27	30	.44	27
alr	.20	25	.09	28	.19	22	.17	28	.35	25	.56	20
ourvs	.19	26	.10	27	.20	21	.29	20	.53	13	.22	38
ei	.18	27	.14	23	.10	31	.18	27	.28	29	.46	26
sch	.18	28	.03	45	.08	32.5	.11	36	.24	31	.47	25
pd	.17	29	.08	31	.14	24.5	19	26	.39	24	.33	31
alt	.16	30	.05	38	.11	30	.20	24	.50	16	.61	16
bet	.16	31	.04	42	.05	39.5	.09	41	.21	34	.62	15
bel	.15	32	.10	26	.07	34	.15	29	.14	40	.44	28
shd	.14	33	.05	37	.02	62	.13	33	.21	33	.37	30
ton	.13	34	.14	22	.12	27.5	.13	32	.23	32	.05	61.5
tgr	.12	35	.04	40	.02	60	.13	34	.17	37	.28	35
hm	.11	36	.08	32	.07	35	.14	31	.12	44	.14	44
alw	.10	37	.08	30	.08	32.5	.09	42	.17	38	.14	45
abv	.10	38	.06	35	.07	38	.12	35	.13	43	.15	43
perh	.09	39	.01	52	.02	57.5	.10	39	.26	27	.29	32.5
themvs	.09	40	.02	54	.12	27.5	.08	43	.06	55.5	.29	32.5
bes	.08	41	.03	44	.02	59	.06	48	.10	48.5	.28	36
beh	.08	42	.05	36	.03	48	.10	37	.11	46	.11	47
wd	.08	43	.08	29	.03	49	.08	45	.06	58	.08	52
qk	.07	44	.01	61	.05	39.5	.08	44	.18	36	.16	42
xf	.07	45	.01	60	.02	56	.10	38	.16	41	.43	24
hmf	.07	46	.03	43	.00		.09	40	.19-	35	.17	41
g	.07	47	.06	34	.07	36	.05	50	.08	51.5	.10	49.5
alm	.06	48	.01	58	.03	52	.05	53	.13	42	.20	39
tod	.06	49	.03	48.5	.02	61	.07	46	.08	51.5	.10	49.5
af	.06	50	.04	39	.05	42	.06	47	.02	67	.08	54

Error Indices for Category VI (continued)

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
mch	.05	51	.03	48.5	.05	43	.04	55	.06	59	.11	46
xs	.05	52	.07	33	.04	44	.04	56	.05	61	.01	70
herf	.05	53	.02	55	.00		.05	52	.15	39	.11	48
gd	.04	54	.01	68	.00		.01	70	.08	53	.10	51
lr	.04	55	.02	51	.03	47	.04	58	.06	57	.06	57
acr	.04	56	.01	67	.05	41	.03	63	.11	46	.07	55
yrf	.04	57	.01	63	.03	51	.06	49	.09	50	.08	53
bef	.04	58.5	.03	64	.01	65	.04	54	.07	54	.05	60
yr	.04	58.5	.02	56	.07	37	.04	57	.00		.06	58
ab	.03	60	.03	46	.03	53	.03	65	.05	62	.06	59
mst	.03	61	.01	59	.01	66	.05	51	.06	60	.04	63
bec	.03	62	.02	50	.02	55	.03	64	.11	46	.03	68
grt	.03	63	.01	62	.02	63	.03	61	.04	65	.17	40
brl	.03	64	.03	47	.04	45.5	.02	68	.05	63	.03	66
o'c	.03	65	.01	66	.00		.03	60	.10	48.5	.04	64
myf	.02	66	.02	53	.04	45.5	.02	67	.00		.07	56
agst	.02	67	.00		.02	57.5	.03	62	.06	55.5	.05	61.5
ll	.02	68	.01	65	.03	50	.03	66	.03	66	.03	69
chn	.02	69.5	.00		.01	64	.03	59	.01	68	.03	65
cd	.02	69.5	.02	57	.02	54	.02	69	.04	64	.03	67
sd	.01	71	.00		.01	67	.01	71	.01	69	.01	71

Error Indices for Category VII, Combinations of Abbreviations and Contractions

Words	All Grades	Rank	Sixth	Rank	Fifth	Rank	Fourth	Rank	Third	Rank	Second	Rank
here-after	.83	1	.81	1	.89	1	.82	1	.82	1	.87	2
succeed	.35	2	.18	3	.38	2	.47	2	.76	2	.60	5
discov-ered	.34	3	.08	9	.12	6	.29	3	.60	4	.86	3
wording	.29	4	.27	2	.34	3	.29	4	.33	8	.33	8.5
distance	.23	5	.09	8	.09	11	.28	5	.64	3	.91	1
through-out	.22	6	.11	6	.21	4	.28	6	.52	5	.67	4
bright-ness	.20	7	.12	5	.13	5	.22	7	.41	6	.49	6
worked	.13	8	.04	15	.03	24	.15	9	.31	9	.21	16
brighter	.12	9	.12	4	.11	9.5	.11	10	.07	22.5	.33	8.5
beautiful	.11	10	.05	13	.05	17	.18	8	.15	16	.13	23
reach	.11	11	.06	10	.09	12	.10	13	.24	10.5	.26	12
different	.09	12	.02	21	.04	23	.06	18	.23	13	.42	7
rubbing	.09	13	.04	16	.09	13	.06	17	.19	15	.29	11
fingers	.09	14	.05	14	.12	7.5	.10	12	.24	12	.20	17
goodness	.09	15	.02	22	.04	22	.11	11	.24	10.5	.31	10
therefore	.08	16	.03	18	.12	7.5	.10	14	.33	7	.13	21
station	.08	17	.04	17	.05	19	.09	15	.11	17	.14	20
younger	.07	18	.10	7	.07	14.5	.04	24	.07	22.5	.00	
teach	.06	19	.05	12	.07	14.5	.05	19	.07	22.5	.22	14.5
birthday	.06	20	.02	57	.02	29.5	.04	23	.04	28	.17	19
shiny	.05	21	.02	26	.05	16	.05	22	.10	18	.18	18
being	.05	22	.02	24	.01	31	.09	16	.20	14	.24	13
coming	.05	23	.02	20	.02	28	.04	26	.07	19	.09	24
grand-mother	.04	24	.05	11	.05	18	.04	27	.07	20	.03	28
dreamed	.04	25	.02	23	.11	9.5	.03	28	.07	22.5	.22	14.5
understand	.03	26	.02	25	.02	26	.05	20	.00		.13	22
something	.03	27	.01	28	.02	27	.05	21	.04	29	.02	29
when	.03	28	.01	29	.02	25	.03	30	.04	30	.04	26
reading	.02	29	.01	30	.04	20.5	.03	29	.05	26.5	.00	
yesterday	.02	30	.01	32	.00		.04	25	.06	25	.04	27
however	.02	31	.00		.04	20.5	.02	31	.05	26.5	.07	25
thought	.02	32	.03	19	.00		.01	33.5	.00		.00	
grand-father	.01	33	.01	33	.02	29.5	.02	32	.02	31	.00	
think	.01	34	.01	31	.00		.01	33.5	.00		.00	
happened	.00		.00		.00		.01	35	.00		.00	

APPENDIX H

BACKGROUND INFORMATION AND INSTRUCTIONS

INTRODUCTION: In this braille research project, we are seeking to obtain data on about 1,000 braille reading children in schools and classes throughout the country. Many schools and classes are being contacted and are planning to participate in the study.

In the following pages you will find information on:

I. Purpose of the study.
II. Construction of the materials used in the study.
III. Selection of the children who are to participate.
IV. Directions for completing the related information needed on each child.
V. Directions for reporting the results.
VI. Information on what you may expect to obtain from the study.
VII. Directions for administration of the materials.

1. General directions for administration.

2. Specific directions for administration with directions for timing and recording the children's responses.

3. Instructions to be given to the children.

I. PURPOSE OF THE STUDY: The purpose of this project is to determine which braille signs, contractions, and abbreviations give most difficulty to children in reading braille.

II. CONSTRUCTION OF THE MATERIALS: A search was made for simple and easy words using all the signs, contractions, and abbreviations. These words were then used with other easy words to construct meaningful and interesting paragraphs for the children to read. The paragraphs utilize all of the signs, contractions, and abbreviations in one or more of their common forms. Almost sixty per cent of the different words used are in the list of 500 most common words compiled by Thorndike as reported in the 1952 printing of his book, The Teacher's Word Book of 30,000 Words.

There are twelve paragraphs or stories. The first three used words generally introduced in pre-primers and primers. Stories four, five, and six use words generally introduced in primers, first, or second grade readers. Stories seven, eight, and nine use words generally introduced in second, or third grade readers. Stories ten, eleven, and twelve use words introduced in third and fourth grade readers, or above.

III. SELECTION OF CHILDREN: Since we wish to determine which signs, contractions, and abbreviations give most difficulty and to see if these difficulties tend to persist, we are choosing children in the second through sixth grades. We would like to concentrate on children in the second, fourth, and sixth grades.

We expect that second graders should be familiar with about two-thirds of the words, i.e., words used up into story eight. Fourth graders should be familiar with words up into story twelve, and sixth graders should be familier with all but the most difficult abbreviations.

We would like all the requested information about each child on the front of the mimeographed test form. Please fill this in as completely as possible before seeing each child.

IV. DIRECTIONS FOR COMPLETING RELATED INFORMATION NEEDED ON EACH CHILD:

We will need information on vision, reading history, intelligence, motivation, performance, and adjustment for each child. It will also be necessary to know if additional handicapping conditions might complicate braille reading.

The face sheet on each individual test form should be filled out completely on each child. Please consult school records for the necessary information.

V. DIRECTIONS FOR REPORTING THE RESULTS: Results can be reported fully on the inkprint test form. Record all errors as directed in VII.2., below, with the time in minutes and seconds. Return these forms on all children who participate in the study to:

S. C. Ashcroft, Director of Educational Research
American Printing House for the Blind
1839 Frankfort Avenue
Louisville, Kentucky

VI. Information on the findings of the complete study will be sent you at the conclusion of the study. If you desire specific information on the cases you submit, please request it in writing when you return the data on your children who participate.

(continued on page 3.)

VII. DIRECTIONS FOR ADMINISTRATION: Please follow the directions to-the-letter. We will need strict conformity to the directions so that all of the results can be pooled and will be comparable.

GENERAL DIRECTIONS FOR ADMINISTRATION:

1. We would like to have the second, fourth, and sixth graders in your school read the material, the poorest readers as well as the others. As noted above, we would also like information on the third and fifth graders, but would like to concentrate on the second, fourth, and sixth graders.

2. It is necessary that each child be seen individually in a quiet and comfortable setting for oral reading.

3. Time the reading on each paragraph with a watch having a second hand. Record time to the nearest second, for example, 1 min., 32 secs.

4. Allay any fears on the part of the child by assuring him that it is not a test, nor a regular part of his school work, but something we are asking him to do to help us. Assure him no grade or score will be used as a part of his school record.

5. After establishing a comfortable, pleasant working relationship with each subject by chatting about things of interest to him, start by reading the directions.

6. Encourage the child with some positive statement after each paragraph. You might say, "Well, that's fine," or "You did O. K. (all right)," "Very good," etc., and then say, "Let's try the next one."

(continued on page 4.)

SPECIFIC DIRECTIONS FOR ADMINISTRATION:

Recording: Write above each word that is not read precisely as it should be exactly what the child says for that word. If the child automatically corrects himself, mark a "c" after what you have written. If the child hesitates on a word, mark a wavy ~~~ line under it. If, after hesitating, he miscalls the word, record the error exactly with phonetic spelling, if necessary. If he hesitates so long (about 5 seconds) that you are sure he does not know the word, ask him to spell it and record his spelling exactly. Then help him with it, mark a wavy line under it, an SP for spelling, and a WA for word aided. If the child asks what a word is, mark "Q" for question - ask him to spell it - record spelling (mark SP). If the child still fails to get the word, help him and mark WA. If the child tries a word and says, "Is that right?" mark "Q" and, if correct, mark "c." If incorrect, record as stated and aid, marking WA. If the child omits the word, syllable, or letter, encircle it, e.g., (but), (ly), or (s). Write in additional words the child provides with caret (^) to show location. If he repeats a word or phrase one or more times, underline it as many time as it is repeated - as one line for one repetition, two lines for two, etc.

Example of Recording Errors:

My mother and father play with me. Come ^ play with us. We will do what
and me
you like to do. We can make a little house here. It is going to be
Q-ll-WA
just for you and me. Mother said, "I will go and make some good candy.
x Q-c SQ-cyand-WA

You can eat it in the house."

Have each child start with STORY 1. and read each successive story until he makes ten or more errors of the type mentioned above (excepting, of course, repetitions) in one story.

(continued on page 5.)

Be sure to remember to record the time in minutes and seconds in the appropriate spaces after each paragraph has been read. Then check by asking the child the reasons for any hesitancies, recording his response in the space provided on the back of the page.

For instance, without in any way implying a criticism of the child's reading performance, say something like this, "I noticed you hesitated somewhat (considerably) before you read the word _____. Can you tell me what you were thinking about before you went on with your reading?" Do not give any clues or leads to possible reasons for such delay!

After the child's whole reading performance is completed, please be sure to check the statements which most nearly characterize his reading behavior in this situation. If you feel that additional comments are needed to convey just what you mean, feel free to elaborate in any way you see fit.

(See page 6. for Instructions to be Read to Children.)

INSTRUCTIONS TO BE READ TO CHILDREN

"WE'RE TRYING TO FIND OUT HOW CHILDREN READ SOME SHORT STORIES. WE'D LIKE YOU TO HELP US WITH IT. I'D LIKE YOU TO READ THESE STORIES ALOUD FOR ME. SOME ARE EASY AND SOME ARE HARDER. YOU MAY NOT KNOW ALL THE WORDS, AND YOU'RE NOT EXPECTED TO KNOW ALL OF THEM. JUST DO THE BEST YOU CAN. I'LL HELP YOU IF YOU GET STUCK ON A WORD AFTER YOU'VE TRIED TO READ IT, AND AFTER YOU SPELL IT FOR ME. TAKE ALL THE TIME YOU NEED. I'M GOING TO TIME YOU WITH A WATCH, BUT DO NOT RUSH. IT'S BETTER TO GET THE WORDS RIGHT THAN TO HURRY TOO MUCH. HERE'S THE FIRST 'STORY.'"

APPENDIX I

BRAILLE READING MASTERY STUDY

INFORMATION SHEET

Subject Number: _____ (leave blank)

_____
Name of person conducting reading session

_____
School or class

Test date: _____
Yr. Mo. Day

Birth Date: _____
Yr. Mo. Day

(Leave this line blank) _____

Present grade in school: _____

Years in school or class for blind: _____

Years instruction in braille (including present year): _____

_____ M F
Last name First name Middle name Sex

Vision: None ___ Light perception ___ Form perception ___
Snellen rating ___ Other _____

Reading history: Has always read braille only _____
Switched from inkprint to braille _____
(Date and reason for change) _____

_____

_____

Reads both inkprint and braille: Yes ___ No ___

Comment _____

_____

TEACHER'S ESTIMATES: (Check one in each case)

Intelligence:

/ / / / / /
Very Superior Superior Average Below Average Very Dull

Motivation to achieve in school work:

/ / / /
High Average Low

Quality of previous performance in braille reading:

/ / / / / /
Very Superior Superior Average Below Average Very Poor

Quality of performance in other school subjects:

/ / / / / /
Very Superior Superior Average Below Average Very Poor

Adjustment to school life other than school subjects:

/ / / / /
Excellent Good Fair Poor

Additional handicapping conditions: (describe)

Hearing loss _____

Speech _____

Crippling _____

Brain Injury _____

Other _____

Comment _____

_____

_____

Do not write below this line

PARAGRAPHS READ AND TIME

Pars.	Wds.	Cum. Wds.	Time M.	Time S.	No Error
1	53	53	___	___	_____
2	52	105	___	___	_____
3	74	179	___	___	_____
4	67	246	___	___	_____
5	73	319	___	___	_____
6	126	444	___	___	_____
7	121	566	___	___	_____
8	82	648	___	___	_____
9	106	754	___	___	_____
10	78	832	___	___	_____
11	82	914	___	___	_____
12	125	1039	___	___	_____
Total					
12	1039	1039	___	___	_____

CHECK LIST OF FACTORS IN PRESENT READING SESSION

After completion of the reading session please check the items listed below that best describe it. If after completing these items you feel other statements would be helpful, please add them.

The child was:

/_____/_____/_____/
uneasy at ease unconcerned

Motivation to do well was:

/_____/_____/_____/
high average low

Quality of this performance was: (as compared with usual performance, if known)

/_____/_____/_____/_____/_____/
very superior superior average below average very poor

The material appeared to be of:

/_____/_____/_____/_____/_____/
very high interest high interest average interest little interest no interest

The material seemed to be:

/_____/_____/_____/_____/_____/
very easy easy average difficult very difficult

The child seemed to have most difficulty with: (check those that apply)

Abbreviated words	_____	Names	_____
Words with braille contractions	_____	Punctuation	_____
Words largely in full spelling	_____	Other	_____

Comments: _____

_____

General comments on rapport, motivation, performance, interest, material, etc.:

_____

_____

_____

_____

_____

BRAILLE READING MASTERY STUDY

Form 1 Record Blank

1.

My mother and father play with me. Come play with us. We will do what you like do to. We can make a little house here. It is going to be just for you and me. Mother said, "I will go and make some good candy. You can eat it in the house."

Reasons for hesitancies:_____ Time:____ Mins.____ Secs.

2.

Daddy gave me a rabbit. I call her Flopsy. Her feet are white. Her nose is pink. She was a mother. She had some little ones. I do not know where they are this morning. I will go out into the barn to find them. I have some straw for their bed.

Reasons for hesitancies:_____ Time:____ Mins. ____ Secs.

3.

Mother said that we could have a party tomorrow. Father asked how many of the children were coming. He will drive his car. You and your sister must come with him. We will eat our cake on the table by the tree. We can hide eggs from each other under the flowers. Do not tell the others. It will be such a nice day. There will be so much fun for all of us.

Reasons for hesitancies:_____ Time:____ Mins. ____ Secs.

4.

Betty is four years old today. We are getting ready for a party. Mother has worked very hard. I know the name of every child. I will write it upon a card. The card will be for games. I hope Betty will not hear the children come. She will laugh when she finds out about the party. We shall play again after we eat the birthday cake.

Reasons for hesitancies:_____ Time: _____ Mins. _____ Secs.

5.

I have never lived anywhere but right in the city. Grandmother and Grandfather live in the country. I always go to see them in the summer. I began to go when I was two. I still like to go. I know almost as much about the farm as the other children. Father said I should learn much more this summer as I am older. I would like to stay there all the time.

Reasons for hesitancies:_____ Time:_____ Mins. _____ Secs.

6.

The bell rang. "Who can it be?" The question ran through Jerry's mind. He walked across the room. It was a man with a letter. Jerry gave the letter to his mother because he could not read the words. Mother said, "Grandmother wants us to meet her at the station." They got inside their car together. They were at the station when the train came. Jerry discovered grandmother. She was behind the other people. She was coming toward them. Grandmother said, "I have enough gifts in these boxes for all of you. Which of them do you want now?" Jerry took a big box for himself. Mother got a beautiful dress. Father got a shirt. What did Jerry get? He got a big red fire truck.

Reasons for hesitancies:_____ Time:____ Mins. ____ Secs.

7.

Was there ever a child who didn't want to ride on a great big train? Billy got up before eight o'clock without being called. He got dressed as quickly as he could. He felt he wanted to dance down the stairs. When he got to the station they were almost ready to connect the engine. One man stood beside the track. He told the engineer when to stop. Then he went between the engine and car to connect them. Billy was so happy about the train ride. Billy said, "Those long cars! That big engine! There cannot be a better train in the whole world." Billy's mother was glad to see that Billy was so happy. She was quite happy herself.

Reasons for hesitancies:_____ Time:____ Mins. ____ Secs.

8.

Jane said, I went to the zoo yesterday." "Did you enjoy yourself?", Tom asked. "Oh, yes!", said Jane. "I paid my own way. I also bought some peanuts to feed the animals. I forget already how many different animals we saw. There were young ones and old ones. Some were washing themselves and rubbing against the fence. Perhaps the best was the tall giraffe. Its head was above the trees. I am going to write a letter to grandmother about it tonight."

Reasons for hesitancies:_____ Time:____ Mins. ____ Secs.

9.

Something bright and shiny was below the surface of the water. It was lying beyond their reach. It almost made them blind to look at its brightness. Neither Billy nor Bob said anything for a moment. It looked like a million dollars in gold. Whose could it be? Billy said, "Either you or I ought to go tell the police. One of us can stay to watch it. I will, unless you'd rather stay, Bob." "I'll go," said Bob. He had just gone over the hill when a cloud covered the sun. Billy said, "Oh, my goodness!" He saw it was just some old tin cans.

Reasons for hesitancies:_____ Time:_____ Mins. _____ Secs.

10.

There was an accident at school. Although I do not understand how it happened, they had to declare a holiday. That is something that usually doesn't happen. Afterward, I found out that a skunk had gotten into a room. It could not let itself out. It did not take long for everyone to know it for quite a distance and to receive word of the day off. Hereafter, I'm afraid they will be sure to shut the doors.

Reasons for hesitancies:_____ Time:_____ Mins. _____ Secs.

11.

An immediate knowledge of braille is necessary for school. Therefore, braille is taught throughout the early grades. According to some, braille is altogether too difficult to learn. However, it is hard for me to conceive of any better system of touch reading. I do not deceive myself or others by saying it is easy to perceive characters made of dots beneath one's fingers. However, with the spirit to succeed one can become lord of braille. He can rejoice when that day comes.

Reasons for hesitancies:_____ Time: _____ Mins. ____ Secs.

12.

One time Joe dreamed he was a king. He was living in a mansion. He was receiving great honors every day. His people were rejoicing and declaring he was a great king. In the dream, Joe was perceiving himself as younger and brighter than any of the other kings. They had trouble conceiving of one so young being king. One king said, "You will have to study to show yourself approved." Another said, "One must teach oneself to be a great king as we ourselves have done." Joe thought the wording of what the kings said was funny. Just before he woke up, Joe heard himself say, "If all kings have to be like yourselves, I think I'll just be president of the United States!"

Reasons for hesitancies:_____ Time: ____ Mins. ____ Secs.

VITA

Samuel Clements Ashcroft was born on June 14, 1921 in Biloxi, Mississippi. After graduating from Evanston, Illinois High School in 1939, he entered North Park College of Chicago and received the Associate in Arts degree. In 1942 he enlisted in the U. S. Army Air Corps and was commissioned as second lieutenant, navigator in 1945. He completed his Bachelor of Science in Education degree at Northwestern University in 1946. He taught for three years in the Public schools of Battle Creek, Michigan and served for three years as Principal of the Iowa Braille and Sight Saving School. Through study under fellowships at New York University he was awarded the Master of Arts degree in Educational Guidance and Personnel work. In 1952 he entered the Graduate College of the University of Illinois where he held a research assistantship until June, 1953. He was Director of Educational Research at the American Printing House for the Blind from 1953 to 1957. In 1957 he became Assistant Professor of Education and Coordinator of Preparation for Teachers of Visually Handicapped Children at George Peabody College for Teachers.

HV1669 c. 1
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Ashcroft, Samuel Clements
Errors in oral reading of braille at elementary grade levels. 1960.

Date Due

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A
Ashcroft, Samuel Clements
AUTHOR

Errors in oral reading of braille
TITLE at elementary grade levels.
1960.

DATE LOANED	BORROWER'S NAME
~~3/4/66~~	~~Mr. Rodgers~~
~~DEC 15 66~~	~~Mr. Rodgers~~
~~JAN 5 '68~~	~~[illegible]~~